# MAHARSHI DAYANAND SARASWATI UNIVERSITY, AJMER

# पाठ्यक्रम

# SYLLABUS

## FACULTY OF EDUCATION

## SCHEME OF EXAMINATION AND COURSES OF STUDY

## Four year Integrated Teacher Education Programme (ITEP)

**B.Sc.B.Ed. Course (R.I.E. Scheme)**
**Secondary Stage**

**B.Sc. B.Ed. Semester I Examination 2023**
**B.Sc. B.Ed. Semester II Examination 2024**
**B.Sc. B.Ed. Semester III Examination 2024**
**B.Sc. B.Ed. Semester IV Examination 2025**
**B.Sc. B.Ed. Semester V Examination 2025**
**B.Sc. B.Ed. Semester VI Examination 2026**
**B.Sc. B.Ed. Semester VII Examination 2026**
**B.Sc. B.Ed. Semester VIII Examination 2027**


महर्षि दयानन्द सरस्वती विश्वविद्यालय, अजमेर

# Faculty of Education

## Syllabus and Scheme of Examination
## Ordinances for the Four Year Integrated Teacher Education Programme (ITEP) B.Sc.B.Ed. Secondary Stage Course

The M.D.S. University, Ajmer hereby constitutes the following ordinances under Four year Integrated Teacher Education Programme (ITEP) B.Sc.B.Ed. Secondary Stage course - a dual major holistic bachelor's degree, in education as well as in a specialised subject such as Botany/ Chemistry/ Mathematics/ Physics/ Zoology. The ordinance shall govern admission, course of study, examination and other matters relating to the degree of B.Sc.B.Ed. (Secondary Stage with Major in Botany/ Chemistry/ Mathematics/ Physics/ Zoology) under the Faculty of Education.

**1. Eligibility**

The four-year Integrated Teacher Education Programme (ITEP) envisions the creation of passionate, motivated, qualified, professionally trained and well-equipped teachers capable of designing and implementing developmentally appropriate learning experiences for students at different stages of school education. The ITEP seeks to ensure that the prospective teachers are given the highest quality education in content, pedagogy, values, skills and practice. The eligibility for admission to the ITEP leading to the degree of B.Sc. B.Ed. (Secondary Stage with major in Botany/ Chemistry/ Mathematics/ Physics/ Zoology) in as under:

- Candidates should have passed Class XII or equivalent stage of education with a minimum of 50% marks in aggregate or an equivalent grade from a recognized Board/University.
- Candidate has to appear in the National Common Entrance Test (NCET) conducted by the National Testing Agency (NTA) and admission in the programme will be based on Merit of NCTE Score.
- The reservation and relaxation in marks for admission to the candidates belonging to SC/ST/OBC/PwD/EWS and other category shall be as per the rules of the Central Government/State Government whichever is applicable time to time.
- For B.Sc.B.Ed. course candidate must have appeared in the NCET conducted by the National Testing Agency (NTA) in the following domains/subjects as per the requirement of ITEP: Applied Mathematics/ Biology/ Biological Studies/ Biochemistry Biotechnology/ Chemistry/ Computer Science/ Informatics Practices/ Mathematics / Physics.
- NCET total score is calculated on the basis of the sum of marks in seven subjects: Language 1 and 2, Teaching Aptitude, General Test, and three relevant Domain-specific Subjects.
- ITEP, a 4-year dual major degree programme, offers one major in Education and the other major in any one of the discipline Botany/ Chemistry/Mathematics/ Physics/ Zoology with different minor.
- The students seeking admission in any of the above mentioned disciplinary majors in ITEP must have appeared in the respective domain/subject in NCET.
- Students are assigned a disciplinary major based on their opted choice of discipline during online admission process.
- Absence in any NCET subject disqualifies the candidate from consideration for admission.

**2. Programme**

- The Integrated Teacher Education Programme (ITEP) is designed as a comprehensive four-year dual-major degree programme, uniquely focuses on preparing future teachers specializing in the secondary stage of school education encompassing science discipline (B.Sc. B.Ed). The discipline offers a set of major and minor courses customised to provide aspiring teachers with the essential knowledge and skills required for proficient teaching in their selected subjects.

- This degree B.Sc.B.Ed. course is equivalent to B.Sc. (Honours) and B.Ed. degrees of the MDS University Ajmer. Students who pass this programme are considered eligible to pursue Masters Degree in the respective disciplinary majors as per UGC and NCTE regulations.
- The course contents related to disciplinary majors viz Botany/ Chemistry/Mathematics/ Physics/ Zoology offered in B.Sc.B.Ed. degree course are equivalent to that of B.Sc. Honours of MDS University Ajmer. The programme contents related to education components in B.Sc.B.Ed. degree course are equivalent to that of B.Ed. of MDS University Ajmer.
- The programme is meticulously designed and structured in a semester wise format to span eight semesters in total. This allows for a well-organized and comprehensive approach to covering essential content, pedagogy, skills and practical experiences vital for future teachers. Importantly, the programme is flexible and inclusive, allowing for multiple exits and entries, providing students the opportunity to customise their academic path according to their needs and circumstances.
- Students have the opportunity to re-enter in the programme within a three-year period, ensuring the fulfilment of the other required guidelines of University, UGC and NCTE. This flexibility is a testament to the programme's commitment to inclusivity and accessibility, enabling individuals to strike a balance between their educational pursuits and other aspects of life. Moreover, the flexibility extends to the overall completion of the degree, permitting students to complete the ITEP within a maximum period of seven years.
- The Integrated Teacher Education Programme (ITEP) includes a structured and comprehensive school experiences (internship) provision aimed at providing practical, hands-on experience to aspiring teachers. This internship component is a crucial part of the programme, offering students the opportunity to apply the theoretical knowledge and pedagogical techniques in their academic journey. During the internship, students are typically placed in educational settings such as schools or educational institutions, where they actively engage in teaching, classroom management, lesson planning, and other essential teaching responsibilities under the guidance and supervision of experienced mentors.
- The internship provision in the programme will allow students to gain learning insights into the dynamics of a classroom, interact with students, understand diverse learning styles and implement effective teaching learning strategies. It serves as a bridge between academic learning and real-world teaching experiences, preparing students to enter the teaching profession with confidence and competence.
- In essence, the ITEP not only sets a high standard for teacher education but also acknowledges the diverse paths students may take, offering a flexible and supportive structure to accommodate the multifaceted aspects of their educational journey.
- The programme will have a provision of end semester examinations and internal assessments as per structure of the course.

**4. Promotion to next semester**

A candidate shall be promoted to the next semester if she/he achieves a grade point of 4 (Letter Grade P) in all course(s)/paper(s), as per the rules mentioned hereinafter. However, the students may clear their back papers within the stipulated time of seven years. In case of discrepancy, candidates may appeal for revaluation of their end semester examination answer scripts except Practical/School experiences (Internship) and Community Engagement services.

**5. Course Details**

The ITEP B.Sc.B.Ed. Course spans a four-year duration, covering eight semesters of academic study. This unique programme encompasses a dual-major bachelor's degree structure, wherein one major is focuses on Education and the other one is focus on specific disciplinary or interdisciplinary field of knowledge.

The programme framework is structured as follows:

A. Foundation of Education (30 Credits):
    a. Nine Core Courses
    b. One Elective in Education
B. Disciplinary/Interdisciplinary (80 Credits):
    a. 14 Core Courses in the chosen major
    b. 2 Discipline-Specific Elective Courses
    c. 3 Courses as Minor
    d. 2 interdisciplinary courses
C. Stage-Specific Content-Cum-Pedagogy (16 Credits):
    a. 4 Courses
D. Ability Enhancement and Value-Added Courses (28 credits):
    a. 10 Courses
E. School Experiences (20 credits):
    a. 6 Courses (Internship)
F. Community Engagement and Services (2 credits):
    a. One Course

This comprehensive programme structure ensures a well-rounded educational experience, combining a strong foundation in education with specialized knowledge in a chosen discipline. This programme also provides students with a holistic perspective, preparing them to excel as teachers in their respective fields.

**6. B.Sc. B.Ed. (Bachelor of Science and Bachelor of Education)**

Five disciplinary majors: Botany/Chemistry/ Mathematics/Physics,/and Zoology,with different minor course combinations outlined in the Table below:

| S.N. | Major Subject area | Maximum seats to opt Major subject | Minor subject Area (minimum 10 Seats for each subject) |
|---|---|---|---|
| **1.** | Botany | 20 | Physics, Mathematics, Chemistry Physical Education and Yoga, Hindi, English, Urdu, Economics, Geography, History and Political Science |
| **2.** | Chemistry | 20 | Physics, Mathematics, Zoology, Botany, Physical Education and Yoga, Hindi, English, Urdu, Economics, Geography, History and Political Science |
| **3.** | Mathematics | 20 | Physics, Zoology, Botany, Chemistry Physical Education and Yoga, Hindi, English, Urdu, Economics, Geography, History and Political Science |
| **4.** | Physics | 20 | Mathematics, Zoology, Botany, Chemistry Physical Education and Yoga, Hindi, English, Urdu, Economics, Geography, History and Political Science |
| **5.** | Zoology | 20 | Physics, Mathematics, Chemistry Physical Education and Yoga, Hindi, English, Urdu, Economics, Geography, History and Political Science |

**6. Programme Learning Outcomes (PLOs)**

Programme Learning outcomes of ITEP B.Sc.B.Ed. Secondary Stage course are to achieve the creation of passionate, motivated, qualified, professionally trained, and well-equipped teachers capable of designing and implementing developmentally appropriate learning experiences for students at secondary stage of school

education. Also ensure that the prospective teachers are given the highest quality education in content, pedagogy, skills, values and practices.

**7. Examinations**

- There shall be a University examination at the end of each semester as per details of the scheme of examination.
- A candidate will be permitted to appear in the end semester examination only if she/he has pursued a regular course of study and attended at least 80% of the classes for all the course work and practicum and 90% for school experiences (Internship) and community engagement & services.
- In order to qualify for B.Sc. B.Ed. degree course a candidate should obtain a minimum of 40% marks in theory and practicals separately, wherever applicable in each subject in each semester of the programme and 50% marks in school experiences (Internship).
- B.Sc.B.Ed. course offers the partial carry over scheme as-
    - For admission to semester VII, candidates should have successfully cleared all the papers of semesters I and II.
- If a candidate fails to clear any course(s)/paper(s) in odd/even semesters in the first attempt, she/he is allowed to clear the back paper(s) in two more consecutive attempts in odd/even semesters only. Odd semester (I, III, V, VII) is from July to December and even semester (II, IV, VI, VIII) is from January to June. The respective end semester examinations shall normally be held in November-December and May-June every year.
- A candidate will be given maximum of **three attempts** (first attempt as main examination and two attempts as reappear examinations) to pass the examination of any paper(s) in the permissible semester of the programme. The candidate has to complete the programme within maximum **seven years**, which includes duration of the programme i.e. four years. If she/he does not pass the examination even after seven years, she/he will not be eligible for award of Degree.
- A candidate will not be required to appear in practical(s)/internal assessment(s) if she/he has already cleared the same. A candidate who fails in any paper(s) of theory examination but passes in practical(s)/internal assessment(s), she/he will be required to reappear again in that paper(s) of theory. However, marks obtained in practical(s)/internal assessment(s) will be carried over.
- No improvement in course(s)/ paper(s) will be allowed if the candidate has secured pass marks in the course(s)/paper(s).
- Division /grade will be awarded to the successful candidates only after the $8^{th}$ semester examination and on the basis of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) obtained in all the eight semesters of the programme in all the subjects including school experiences (Internship).
- Institute will submit the consolidated marks of the internal assessments and practical examinations to the Controller of Examination of the University, not later than seven days at the end of the semester.
- A variety of assessment methods that are appropriate to a given disciplinary/subject area and a programme of study are used to assess progress toward the course/programme learning outcomes. Priority is accorded to formative assessment. Evaluation is based on continuous assessment, in which sessional assessment, mid semester and the end semester examinations contribute to the final grade.
- The assessment is "Formative and Summative" in nature. The assessment of students is based on
    - Assessment methods align with the specific discipline or subject area and the programme of study, ensuring appropriateness.

- Assessing progress towards course and programme learning outcomes.
- Continuous assessment, incorporating sessional assessment and terminal examination contributions for determining the final grade.
- Assessment weightage: 30% for formative assessment and 70% for summative assessment.
- Minimum passing requirement of marks for each course in a semester is 40%, (theory, tutorial, practical, and practicum components); however, in school experiences (Internship), a candidate is required to secure 50% marks. Candidate is required to pass in theory and practical separately.
- If a candidate fails to secure 40% marks in any course, she/he they will have to clear that particular course(s)/papers(s) (back papers) in subsequent semesters.
- Candidates with back papers have the opportunity to clear them within seven years from the date of Admission.
- Re-evaluation is allowed only in theory papers of the End Semester External Examinations excluding Practical and School Experiences (Internship) as per university rules.

**Question paper Patterns**

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attemept one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%
- Internal assessment will be as detailed in corrsosponding course/paper.

## 8. Grading System (Absolute/Relative)

The Semester Grade Point Average (SGPA) is computed from the grades to evaluate the student's performance in a given semester. The SGPA is based on the grades of the current term, while the Cumulative GPA (CGPA) is based on the grades in all courses taken after joining the course of study. The Regional Institute of Education, Ajmer has given the option to display not only the course grades but also the marks acquired in each course. Additionally, they may calculate and present a weighted average of marks, considering the marks achieved across all semesters for providing valuable information to the students.

| Letter Grade | Grade Point |
|---|---|
| O (outstanding) | 10 |
| A+ (Excellent) | 9 |
| A (Very good) | 8 |
| B+ (Good) | 7 |
| B (Above average) | 6 |
| C (Average) | 5 |

| | |
|---|---|
| P (Pass) | 4 |
| F (Fail) | 0 |
| Ab (Absent) | 0 |

- **Computation of SGPA and CGPA**

The procedure has been adopted to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) as per UGC recommendations.

The SGPA is the ratio of the sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

**SGPA** (Si) = ∑ (Ci x Gi) / ∑Ci

Where Ci is the number of credits of the $i^{th}$ course and Gi is the grade point scored by the student in the $i^{th}$ course.

**Example for Computation of SGPA**

| **Semester** | **Course** | **Credit** | **Letter Grade** | **Grade point** | **Credit Point** (Credit x Grade) |
|---|---|---|---|---|---|
| I | Course 1 | 3 | A | 8 | 3 X 8 = 24 |
| I | Course 2 | 4 | B+ | 7 | 4 X 7 = 28 |
| I | Course 3 | 3 | B | 6 | 3 X 6 = 18 |
| I | Course 4 | 3 | O | 10 | 3 X 10 = 30 |
| I | Course 5 | 3 | C | 5 | 3 X 5 = 15 |
| I | Course 6 | 4 | B | 6 | 4 X 6 = 24 |
| | | 20 | | | 139 |
| | **SGPA** | | | | 139/20=**6.95** |

The Cumulative Grade Point Average (CGPA) is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

**CGPA** = ∑(Ci x Si) / ∑ Ci

where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

**Example for Computation of CGPA**

| **Semester 1** | **Semester 2** | **Semester 3** | **Semester 4** | **Semester 5** | **Semester 6** |
|---|---|---|---|---|---|
| Credit: 21<br>SGPA:6.9 | Credit: 22<br>SGPA:7.8 | Credit:25<br>SGPA:5.6 | Credit: 26<br>SGPA:6.0 | Credit: 26<br>SGPA: 6.3 | Credit 25<br>SGPA 8.0 |

The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

**Transcript (Format):** Based on the above recommendations on Letter grades, grade points, SGPA and CCPA, the university issues the transcript for each semester and a consolidated transcript indicating the performance in all semesters.

9. **Transfer of Credits**
   **Transfer of Credits corresponding to the ITEP will be as per the UGC rules (https://www.ugc.gov.in/pdfnews/5266217_Draft-version-ABC-Regulations-2021-SPT-02-01-2021.pdf)**
10. **School Experiences (Internship):** activities pertaining to school experiences are as follows:

- ***Pre-Internship Practice*** (Preparation for School Experience):

► Orientation on School Experience.

► Demonstration lessons by Teacher Educators and/or by expert teachers.

► Peer Teaching - I: Pedagogy of chosen subjects relating to two of the curricular areas such as Interdisciplinary Areas, Mathematics, and Science included in the curriculum for Grades 9 & 10.

► Peer Teaching - II: Pedagogy of chosen subjects from two of the curricular areas such as Interdisciplinary Areas, Mathematics, and Sciences, included in the curriculum for Grades 9 & 10.

► **School observation involving:**

Observation of teaching-learning activities in Grades 9-12 in Schools; Observation of full school activities with special focus on Grades 9-12.

Observation of Government and Private Schools across as many contexts as possible (e.g., Rural, Urban, Residential, Schools with alternative approaches, Ashram schools, Demonstration Multipurpose Schools (DMS) etc.).

Observation of full school activities with special focus on Grades 9 – 12.

- ***Practice Teaching:***

► Assisting classroom teachers in Grades 9-12 in schools – Focus on teaching of subjects relating to two of the curricular areas such as Interdisciplinary Areas, Mathematics, and Sciences, prescribed for study in Grades 9 & 10 (no independent teaching).

► Block/Unit Teaching in school: Planning for Teaching; Taking classes observed by the classroom teacher (no teaching without the classroom teacher present); Classes in two chosen subjects relating to two of the curricular areas, i.e., Interdisciplinary Areas, Mathematics and Sciences, prescribed for study in Grades 9 & 10. Equal time shared two curricular areas and vocational education; teaching a logical set of lessons or a complete unit closely observed by classroom teachers with equal time with children in Grades 9, 10, 11 & 12 in schools.

- **School Internship:**

► Independent Teaching, equal time shared across two subjects relating to two of the curricular areas, i.e., Interdisciplinary Areas, Mathematics and Sciences prescribed for study in Grades 9-10 (Min: 10 lessons for each subject).

► Observation of transaction of lessons by teachers of Secondary Stage.

► Acting as assistant to the regular classroom teacher before taking independent charge of classroom teaching at the Secondary Stage.

► Independent Teaching, equal time shared across two subjects relating to two of the curricular areas, i.e., Interdisciplinary Areas, Mathematics, and Sciences prescribed for study in Grades 9-10.

- ► Providing support to carry out everyday activities of schools (e.g., conducting the school assembly, organising various school events. etc.).
- ► Exposure to school administrative practices (e.g. maintaining administration records, creating an annual calendar, etc.).
- ► Participation in all aspects of teaching - preparation, planning, developing/ collecting/localising teaching-learning material, classroom transactions, and learning assessment processes.

- **Creating Teaching-Learning Material:**

- ► Development of relevant teaching-learning material for specific groups of children with whom the student-teacher had interacted during their school experiences.
- ► Development of Vocational skill based projects, Maps, Science Experiments, Projects having linkages with industry etc.

**11. Community Engagement and Service**

The educational segment focusing on 'community engagement and service' endeavours to immerse student-teachers in understanding socio-economic challenges within society. It aims to introduce them to community-driven development initiatives, enriching their academic knowledge with practical life encounters, ultimately fostering the capacity to devise solutions for real-world issues. This course is meticulously designed to cultivate a deeper understanding of community dynamics, augment the student-teachers' proficiency in garnering community backing for school-related initiatives, advocate for the importance of education, and shed light on matters concerning schooling, children's health, and overall well-being. Additionally, it strives to sensitize and galvanize community members to address prevalent social, cultural, and educational obstacles.

**12. Evaluation:** Rules and Regulations

- Attendance: Following are the rules relating to attendance requirements:
- Every candidate is expected to have 100% attendance in each subject in which she/he has registered at the beginning of the semester. However, in case of attendance less than mandatory 80%, condonation for shortage of attendance up to 20% may be granted by the Head of the Institution.
- A candidate not having the mandatory requirement of minimum 80% attendance in any course(s)/paper(s), shall not be permitted to appear for the end semester examination in that course(s)/paper(s) and is awarded 'FA' (Insufficient attendance) grade.
- Curse(s) If the period of leave exceeds two weeks, application for leave shall have to be submitted to the Head of the Institution, stating fully the reasons for the leave requested along with supporting document(s). The Head of the Institution will grant such leave and the candidate will be marked as absent during that period.
- Absence for a period not exceeding two weeks in a semester due to sickness or any other valid reason for which prior application could not be made; the leave may be granted expost- facto by the Head of the Institution provided She/he is satisfied with the explanation.
- Candidates who represent their Institute/ University/ State/ Nation in recognized sports/ games/ cultural/ literary/ NCC/ NSS activities will get credit of attendance for that period. This will be allowed on production of a certificate from the concerned organizing authority and on the basis of the recommendations of the Head of the Institution.
- A candidate representing the Institute in approved activities such as Games & Sports, Literary & Cultural Meets, Seminar, Workshop, Conference and Interview arranged through Placement Cell shall be considered as on-duty subject to a maximum of five days in a semester. Prior permission from

Head of the Institution is required for availing on duty permission. However, this period of absence shall be counted as present for the purpose of computation of attendance.

- I: for "Incomplete Assessment", when the candidate misses the end-semester examination on medical grounds.
- FA: for "Insufficient Attendance" in the course(s)/ paper(s).
- W: for "Withdrawal" from the programme.
- X: for "Debarred" on grounds of indiscipline/ malpractices in examinations.

**Awarding UG Certificate, UG Diploma, and Degrees**

**Certificate in Integrated Teacher Education Programme (Undergraduate Certificate)**

Students who opt to exit after completion of the first year and have secured 40 credits will be awarded a UG certificate if, in addition, they complete one vocational course of 4 credits during the summer vacation of the first year. These students are allowed to re-enter in the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

**Diploma in Integrated Teacher Education Programme (UG Diploma in ITEP)**

Students who opt to exit after completion of the second year and have secured 80 credits will be awarded the UG diploma if they complete one vocational course of 4 credits during the summer vacation of the second year. These students are allowed to re-enter within a period of three years and complete the degree programme within the maximum period of seven years.

**Bachelor of Science (B.Sc.) Degree:** Students who wish to undergo a 3-year UG programme will be awarded a UG Degree in the major discipline after completing three years, securing 120 credits, and satisfying the minimum credit requirement.

**B.Sc.B.Ed. (Secondary Stage with Major in Botany/Chemistry/Mathematics/ Physics/ Zoology) degree**

A four-year UG dual major degree will be awarded to those who complete a four-year degree programme with minimum 160 credits and have satisfied the credit requirements.

## 14. Reappear Examination:

- Candidates appearing in reappear examination for clearing their back papers shall be governed by the following rules:
- Candidates with "FA" Grade are not eligible for writing the reappear examination unless She/he completes the required attendance.
- Candidates with "F" and "I" Grade only are eligible to write reappear examination.
- A candidate who has obtained "F" Grade in Reappear examination may register in the permissible semester.
- Candidates can apply for re-evaluation in any of the theory examination as per rules stipulated by the University.

**15. Miscellaneous:**

- These regulations will apply to the candidates admitted for the academic year 2023-24 and onwards.

- Statutes/ Ordinances/ Rules/ Regulations/ Syllabi may be amended by the University from time to time.
- Other regulations not specifically mentioned above are as per the regulations of the University as applicable from time to time.
- Any issue not envisaged above, shall be resolved by the Vice-Chancellor in consultation with the appropriate Bodies of the University, which shall be final and binding.
- Legal matters are subject to the jurisdiction of Ajmer.

**Curricular Structure of the Four Year Integrated Teacher Education Programme (ITEP) B.Sc.B.Ed.**
**Secondary Stage Course**

| **ITEP Structure** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S.N. | Curricular component | Courses | Credits* per semester** | | | | | | | | Total Credits | |
| | | | S-1 | S-2 | S-3 | S-4 | S-5 | S-6 | S-7 | S-8 | | |
| | | **Two Week Induction Programme** | | | | | | | | | | |
| 1.1 | 1.Foundaions of Education | Evolution of Indian Education | 4 | -- | -- | | -- | -- | -- | -- | 4 | 30 |
| 1.2 | | Philosophical & Sociological Perspectives of Education – I | -- | -- | -- | 4 | -- | -- | -- | -- | 4 | |
| 1.3 | | Child Development & Educational Psychology | -- | -- | 4 | -- | -- | -- | -- | -- | 4 | |
| 1.4 | | Philosophical & Sociological Perspectives of Education – II | -- | -- | -- | -- | -- | -- | -- | 4 | 4 | |
| 1.5 | | Curriculum Planning & Development (textbooks, material development, etc.) – (Stage Specific) | -- | -- | -- | -- | -- | -- | 2 | -- | 2 | |
| 1.6 | | Assessment & Evaluation | -- | -- | -- | -- | | 2 | -- | -- | 2 | |
| 1.7 | | Inclusive Education | -- | -- | -- | -- | -- | 2 | -- | -- | 2 | |
| 1.8 | | Perspectives on School Leadership and Management | | -- | -- | -- | -- | -- | 2 | -- | 2 | |
| 1.9 | | Education Policy Analysis | -- | -- | -- | -- | -- | -- | -- | 2 | 2 | |
| 1.10 | | One Elective from the offered courses (Adolescence Education/Art Education/Education for Mental Health/Education for Sustainable Development/Emerging Technologies in Education/Gender Education/ Guidance and Counselling/Peace Education/ Sports and Fitness Education) | -- | -- | -- | -- | -- | -- | -- | 4 | 4 | |
| 2.1 | 2.Disciplinary Courses (With Elective Courses) | Two disciplines from any of the school curricular areas:<br>i. Language & Literature<br>ii. Physical Sciences (Physics, Chemistry, etc.)<br>iii. Mathematics<br>iv. Biological Sciences (Zoology, Botany, etc.)<br>v. Social Sciences ( History, Geography, | 8 | 12 | 8 | 8 | 11 | 8 | -- | -- | 55 | 64 |
| | Skill Enhancement Courses (SEC) | | - | - | 3 | 3 | - | 3 | - | - | 9 | |
| | Disciplinary Specific Minor | i. Language & Literature<br>ii. Physical Sciences (Physics, | 4 | - | 4 | 4 | - | - | - | - | 12 | 12 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Courses | Chemistry, etc.)<br>iii. Mathematics<br>iv. Biological Sciences (Zoology, Botany, etc.)<br>v. Social Sciences (Economics, History, Geography, Sociology, Psychology, Political Science etc.)<br>vi. Physical Education and Yoga | | | | | | | | | | |
| | Inter Disciplinary Courses | A-Biodiversity and conservation<br>B-Chemical Technology and Society<br>C- Mathematical Modelling<br>D-NanoScience<br>E- Wetland Conservation | - | 2 | - | - | 2 | - | - | - | 4 | 4 |
| 3.1 | 3.Pedagogy Courses | Stage Specific Content-cum-Pedagogy Courses | -- | -- | 4 | 4 | 4 | 4 | -- | -- | 16 | 16 |
| 4.1 | 4.Ability Enhancement & Value – Added Courses | Language 1 (as per the 8th schedule of constitution of India) | 4 | | -- | -- | -- | -- | -- | -- | 4 | 28 |
| 4.2 | | Language 2 (Other than L1) | -- | 4 | -- | -- | -- | -- | -- | -- | 4 | |
| 4.3 | | Art (Performing and Visual) & Creative Expressions | 2 | -- | -- | -- | -- | -- | 2 | -- | 4 | |
| 4.4 | | ICT in Education | -- | -- | -- | -- | 2 | -- | -- | -- | 2 | |
| 4.6 | | Mathematical & Quantitative Reasoning | -- | -- | -- | -- | -- | 2 | -- | -- | 2 | |
| 4.7 | | Sports, Nutrition and Fitness | -- | -- | | -- | -- | -- | 2 | -- | 2 | |
| 4.8 | | Yoga and Understanding Self | -- | -- | | -- | -- | -- | -- | 2 | 2 | |
| 4.9 | | Understanding India (Indian Ethos and Knowledge Systems) | 2 | 2 | -- | -- | -- | -- | -- | -- | 4 | |
| 4.10 | | Citizenship Education, Sustainability and Environment Education | -- | -- | -- | -- | -- | -- | -- | 2 | 2 | |
| 4.11 | | Teacher and Society | -- | 2 | -- | -- | -- | -- | -- | -- | 2 | |
| 5.1 | 5.School Experience | Pre-Internship Practice (Demo, lessons, Peer teaching) | -- | -- | -- | -- | 2 | -- | -- | -- | 2 | 20 |
| 5.2 | | School Observation (Field Practice) | -- | -- | -- | -- | -- | 2 | -- | -- | 2 | |
| 5.3 | | School based research project | -- | -- | -- | -- | -- | -- | 2 | -- | 2 | |
| 5.4 | | Internship in Teaching | -- | -- | -- | -- | -- | -- | 10 | -- | 10 | |
| 5.5 | | Post Internship (Review and Analysis) | -- | -- | -- | -- | -- | -- | -- | 2 | 2 | |
| 5.6 | | Creating Teaching Learning Material/Work Experience (Educational Toy making, local/traditional vocations, etc.) | -- | -- | -- | -- | -- | -- | -- | 2 | 2 | |
| 6 | Community Engagement | Community Engagement and Service (Adult Education, etc.) | -- | -- | -- | -- | -- | -- | -- | 2 | 2 | 2 |
| | | Total | 24 | 22 | 23 | 23 | 21 | 23 | 20 | 20 | 176 | 176 |

# ITEP Structure and Scheme of Examination

| B.Sc.B.Ed. Semester-I | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Courses** | **Paper Code** | **Course/paper** | **Periods per Week L+T+P** | **Credits** | **Internal/External** | | | **Max. marks** | **Exam Duration** |
| | | | | | **Internal** | | **External** | | |
| | | | | | **Th.** | **Pr.** | **Ext.** | | |
| SIP | SIP | Student Induction programme for Two Week | - | - | - | - | - | - | 4 hrs. Per day |
| EC | EDFE-101 | Evolution of Indian Education | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| *DSC Major Courses | DCBO-101 | Basic concepts of Botany | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCBO-102 | Diversity of Microbes-I (Virus, Bacteria and Algae) | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCCH-101 | General Chemistry-I | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCCH-102 | Inorganic Chemistry-I | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCMA-101 | Calculus-I | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCMA-102 | Real Analysis-I | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCPY-101 | Mechanics | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCPY-102 | Mathematical Physics | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCZO-101 | Biology of Non-Chordates | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCZO-102 | Animal Taxonomy and Biodiversity | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| **DSC Minor Courses | DCBO-101 | Basic concepts of Botany | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCCH-101 | General Chemistry-I | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCMA-101 | Calculus-I | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCPY-101 | Mechanics | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCZO-101 | Biology of Non-Chordates | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| Ability Enhancement and value Added Courses | AEVA-101 | Language I (as per the 8th schedule of constitution of India) | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | AEVA-102A | Art Education (Performing and Visual) and Creative Expressions Exemplar 1 - Puppetry | 1+0+1 | 2 | 10 | 5 | 35 | 50 | 2hrs. |
| | AEVA-103 | Understanding India (Indian Ethos and Knowledge Systems) | 1+1+0 | 2 | 10 | 5 | 35 | 50 | 2hrs. |
| **Total Credits** | | | | **24** | **Total** | | | **600** | |
| ***200 Marks:** One Major in Botany (DCBO-101 & 102)/Chemistry (DCCH- 101 & 102)/Mathematics (DCMA-101 & 102)/Physics (DCPY-101 & 102)/Zoology (DCZO-101 & 102). ****100 Marks:** One Minor in Botany (DCBO-101)/Chemistry (DCCH-101)/Mathematics (DCMA-101)/Physics (DCPY-101)/Zoology (DCZO-101). | | | | | | | | | |
| **Semester-II** | | | | | | | | | |
| *DSC Major Courses | DCBO-201 | Diversity of microbes II (Fungi & Lichen) | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCBO-202 | Diversity of Cryptogams (Bryophytes and Pteridophytes) | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCBO-203 | Plant Cell Biology | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCCH-201 | Inorganic Chemistry-II | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCCH-202 | Organic Chemistry-I | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCCH-203 | Physical Chemistry-I | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCMA-201 | Calculus-II | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCMA202 | Real Analysis-II | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCMA-203 | Abstract Algebra-I | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCPY-201 | Optics | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCPY-202 | Oscillations, Waves and Acoustics | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCPY-203 | Relativity | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCZO-201 | Cell and Molecular Biology | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCZO-202 | Genetics and Evolution | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCZO-203 | Biochemistry | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| **Inter Disciplinary Course (Any One) | INDC-201 | A-Biodiversity and conservation B-Chemical Technology and Society C- Mathematical Modelling D-NanoScience E- Wetland Conservation | 1+1+0 | 2 | 10 | 5 | 35 | 50 | 2hrs. |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Ability Enhancement Course | AEVA-201 | Language II (Other than Language I) | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | AEVA-202 | Understanding India (Indian Ethos and Knowledge Systems) | 1+1+0 | 2 | 10 | 5 | 35 | 50 | 2hrs. |
| | AEVA-203 | Teacher and Society | 1+1+0 | 2 | 10 | 5 | 35 | 50 | 2hrs. |
| **Total Credits** | | | | **22** | **Total Marks** | | | **550** | |
| ***300 Marks:** One Major in Botany (DCBO-201, 202 & 203)/Chemistry (DCCH- 201, 202 & 203)/Mathematics (DCMA-201, 202 & 203)/Physics (DCPY-201, 202 & 203)/Zoology (DCZO-201, 202 & 203).<br>****50 Marks:** One Interdisciplinary Course (INDC-201) Any One. | | | | | | | | | |
| **Semester-III** | | | | | | | | | |
| EC | EDFE-301 | Child Development & Educational Psychology | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| *DSC Major Courses | DCBO-301 | Diversity of Seed Plants (Gymnosperms and Palaeobotany) | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCBO-302 | Genetics and Plant breeding | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCCH-301 | General Chemistry-II | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCCH-302 | PhysicalChemistry-II | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCMA-301 | Ordinary Differential Equation | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCMA-302 | Abstract Algebra-II | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCPY-301 | Electricity and Magnetism | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCPY-302 | Solid State Physics | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCZO-301 | Biology of Chordates | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCZO-302 | Developmental Biology | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| **Skill Enhancement Course (Any One) | DCSC-301 | Nursery and gardening Techniques | 2+0+1 | 3 | 15 | 10 | 50 | 75 | 3hrs. |
| | DCSC-302 | Applications of Computers in Chemistry | 2+0+1 | 3 | 15 | 10 | 50 | 75 | 3hrs. |
| | DCSC-303 | Discrete Mathematics | 2+1+0 | 3 | 15 | 10 | 50 | 75 | 3hrs. |
| | DCSC-304 | Physics Laboratory and Wood Workshop Skills | 2+0+1 | 3 | 15 | 10 | 50 | 75 | 3hrs. |
| | DCSC-305 | Livestock Management | 2+0+1 | 3 | 15 | 10 | 50 | 75 | 3hrs. |
| ***DSC Minor Courses | DCBO-301 | Genetics and Plant breeding | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCCH-301 | General Chemistry-II | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCMA-301 | Ordinary Differential Equation | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCPY-301 | Electricity and Magnetism | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCZO-301 | Biology of Chordates | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| Pedagogy Courses | EDPC-301 | General Pedagogy: Basic of Pedagogy at Secondary Stage | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| **Total Credits** | | | | **23** | **Total Marks** | | | **575** | |
| ***200 Marks:** One Major in Botany (DCBO-301 & 302)/Chemistry (DCCH- 301 & 302)/Mathematics (DCMA-301 & 302)/Physics (DCPY-301 & 302)/Zoology (DCZO-301 & 302).<br>****75 Marks:** Skill Enhancement Course (DCSC) Any One DCSC-301/302/303/304/305.<br>*****100 Marks:** One Minor in Botany (DCBO-301)/Chemistry (DCCH-301)/Mathematics (DCMA-301)/Physics (DCPY-301)/Zoology (DCZO-301). | | | | | | | | | |
| **Semester-IV** | | | | | | | | | |
| EC | EDFE-401 | Philosophical & Sociological Perspectives of Education – I | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| *DSC Major Courses | DCBO-401 | Biosystematics and Anatomy | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCBO-402 | Biosystematics and Embryology | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCCH-401 | General Chemistry-III | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCCH-402 | Organic Chemistry-II | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCMA-401 | Partial Differential Equation | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCMA-402 | Linear Algebra-I | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCPY-401 | Thermal Physics | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCPY-402 | Electrodynamics | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCZO-401 | Ethology and Economic Zoology | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCZO-402 | Animal Physiology and Endocrinology | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| **Skill Enhancement Course (Any One) | DCSC-401 | Nursery and gardening technique | 2+1+0 | 3 | 15 | 10 | 50 | 75 | 3hrs. |
| | DCSC-402 | Basic Analytical Techniques | 2+1+0 | 3 | 15 | 10 | 50 | 75 | 3hrs. |
| | DCSC-403 | Elementary Number Theory | 2+1+0 | 3 | 15 | 10 | 50 | 75 | 3hrs. |
| | DCSC-404 | Basic Electronics | 2+0+1 | 3 | 15 | 10 | 50 | 75 | 3hrs. |
| | DCSC-405 | Vector, Diseases & Management | 2+0+1 | 3 | 15 | 10 | 50 | 75 | 3hrs. |
| ***DSC Minor | DCBO-401 | Biosystematics and Anatomy | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Courses | DCCH-401 | General Chemistry-III | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCMA-401 | Partial Differential Equation | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCPY-401 | Thermal Physics | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCZO-401 | Ethology and Economic Zoology | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| Pedagogy Courses (Any Two) | PCMA-401 | Content Cum Pedagogy of Mathematics (CCPM-I) | 1+1+0 | 2 | 10 | 3 | 35 | 50 | 2hrs. |
| | PCPS-402 | Content Cum Pedagogy of Physical Sciences (CCPPS-I) | 1+0+1 | 2 | 10 | 3 | 35 | 50 | 2hrs. |
| | PCBS-403 | Content Cum Pedagogy of Biological Sciences (CCPBS-I) | 1+0+1 | 2 | 10 | 3 | 35 | 50 | 2hrs. |
| **Total Credits** | | | | **23** | **Total Marks** | | | **575** | |
| ***200 Marks:** One Major in Botany (DCBO-401 & 402)/Chemistry (DCCH-401 & 402)/Mathematics (DCMA-401 & 402)/Physics (DCPY-401 & 402)/Zoology (DCZO-401 & 402).<br>****75 Marks:** Skill Enhancement Course (DCSC) Any One DCSC-401/402/403/404/405.<br>*****100 Marks:** One Minor in Botany (DCBO-401)/Chemistry (DCCH-401)/Mathematics (DCMA-401)/Physics (DCPY-401)/Zoology (DCZO-401). | | | | | | | | | |
| **Semester-V** | | | | | | | | | |
| *DSC Major Courses | DCBO-501 | Plant Physiology | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCBO-502 | Plant Physiology and Biochemistry | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCCH-501 | Inorganic Chemistry-III | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCCH-502 | Organic Chemistry-III | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCMA-501 | Linear Algebra-II | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCMA-502 | Complex Analysis-I | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCPY-501 | Quantum Physics | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCPY-502 | Statistical Physics | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCZO-501 | Environmental Biology | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCZO-502 | Instrumentation and Biostatistics | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| **Disciplinary Elective Courses (Any One) | DECB-501 | Herbal medicines and human health | 2+1+0 | 3 | 15 | 10 | 50 | 75 | 3hrs. |
| | DECC-501 A | Reseach Methodology for Chemistry | 2+1+0 | 3 | 15 | 10 | 50 | 75 | 3hrs. |
| | DECC-501 B | Industry and Environment | | | | | | | |
| | DECM-501 A | Mechanics | 2+1+0 | 3 | 15 | 10 | 50 | 75 | 3hrs. |
| | DECM-501 B | Probability and Statistics | | | | | | | |
| | DECP-501 A | Laser and Fiber Optics | 2+1+0 | 3 | 15 | 10 | 50 | 75 | 3hrs. |
| | DECP-501 B | Renewable Energy Sources | | | | | | | |
| | DECZ-501 A | Elementary Fish Biology | 2+1+0 | 3 | 15 | 10 | 50 | 75 | 3hrs. |
| | DECZ-501 B | Wildlife Conservation and Management | | | | | | | |
| ***Inter Disciplinary Course (Any One) | INDC-501 | A: One Inter Disciplinary Course from available list of MOOCs<br>B: Intellectual Property Rights | 1+1+0 | 2 | 10 | 5 | 35 | 50 | 2hrs. |
| Pedagogy Courses (Any Two) | PCMA-501 | Content Cum Pedagogy of Mathematics (CCPM-II) | 1+1+0 | 2 | 10 | 5 | 35 | 50 | 2hrs. |
| | PCPS-502 | Content Cum Pedagogy of Physical Sciences (CCPPS-II) | 1+0+1 | 2 | 10 | 5 | 35 | 50 | 2hrs. |
| | PCBS-503 | Content Cum Pedagogy of Biological Sciences (CCPBS-II) | 1+0+1 | 2 | 10 | 5 | 35 | 50 | 2hrs. |
| Ability Enhancement & Value – Added Courses | AEVA-501 | ICT in Education | 1+1+0 | 2 | 10 | 5 | 35 | 50 | 2hrs. |
| School Experiences | EDSE-501 | Pre-Internship Practice (Demo, lessons, Peer teaching) | 1+1+0 | 2 | - | - | - | 50 | - |
| **Total Credit** | | | | **21** | **Total Marks** | | | **525** | |
| ***200 Marks:** One Major in Botany (DCBO-501 & 502)/Chemistry (DCCH-501 & 502)/Mathematics (DCMA-501 & 502)/Physics (DCPY-501 & 502)/Zoology (DCZO-501 & 502).<br>****75 Marks:** Any One Disciplinary Elective Course (DECB-501, DECC-501A/501B, DECM-501A/501B, DECP-501A/501B, DECZ-501A/501B).<br>*****50 Marks:** One Interdisciplinary Course (INDC-501) Any One. | | | | | | | | | |
| **Semester-VI** | | | | | | | | | |
| EC | EDFE-601 | Assessment & Evaluation | 1+0+1 | 2 | 10 | 5 | 35 | 50 | 2hrs. |
| | EDFE-602 | Inclusive Education | 1+0+1 | 2 | 10 | 5 | 35 | 50 | 2hrs. |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *DSC Major courses | DCBO-601 | Plant Biotechnology | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCCH-601 | Advance Chemistry | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCMA-601 | Complex Analysis-II | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCPY-601 | Nuclear and Particle Physics | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DCZO-601 | Biotechnology | 3+0+1 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| **Disciplinary Elective Courses (Any One) | DECB-601 | Tools and techniques in Botany | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DECC-601 A | Polymer Chemistry | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DECC-601 B | Analytical Clinical Biochemistry | | | | | | | |
| | DECM-601 A | Functional Analysis | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DECM-601 B | Linear Programming and Application | | | | | | | |
| | DECP-601 A | Fundamentals of Astrophysics | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DECP-601 B | Atmospheric Physics | | | | | | | |
| | DECZ-601 A | Aqua Culture | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | DECZ-601 B | Poultry Farming | | | | | | | |
| ***Skill Enhancement Course (Any One) | DCSC-601 | Organic farming | 2+0+1 | 3 | 15 | 10 | 50 | 75 | 3hrs. |
| | DCSC-602 | Instrumental Methods of Chemical Analysis | 2+0+1 | 3 | 15 | 10 | 50 | 75 | 3hrs. |
| | DCSC-603 | Numerical Analysis | 2+1+0 | 3 | 15 | 10 | 50 | 75 | 3hrs. |
| | DCSC-604 | Electricity and Electronics | 2+0+1 | 3 | 15 | 10 | 50 | 75 | 3hrs. |
| | DCSC-605 | Vermiculture | 2+0+1 | 3 | 15 | 10 | 50 | 75 | 3hrs. |
| Pedagogy Courses (Any Two) | PCMA-601 | Content Cum Pedagogy of Mathematics (CCPM-III) | 1+1+0 | 2 | 10 | 5 | 35 | 50 | 2hrs. |
| | PCPS-602 | Content Cum Pedagogy of Physical Sciences (CCPPS-III) | 1+0+1 | 2 | 10 | 5 | 35 | 50 | 2hrs. |
| | PCBS-603 | Content Cum Pedagogy of Biological Sciences (CCPBS-III) | 1+0+1 | 2 | 10 | 5 | 35 | 50 | 2hrs. |
| Ability Enhancement & Value – Added Courses | AEVA-601 | Mathematical & Quantitative Reasoning | 1+1+0 | 2 | 10 | 5 | 35 | 50 | 2hrs. |
| School Experiences | EDSE-601 | School Observations (Field Practice) | 1+1+0 | 2 | - | - | - | 50 | - |
| **Total Credits** | | | | **23** | **Total Marks** | | | **575** | |

***100 Marks:** One Major in Botany (DCBO-601 & 602)/Chemistry (DCCH-601 & 602)/Mathematics (DCMA-601 & 602)/Physics (DCPY-601 & 602)/Zoology (DCZO-601 & 602).
****100 Marks:** Any One Disciplinary Elective Course (DECB-601, DECC-601A/601B, DECM-601A/601B, DECP-601A/601B, DECZ-601A/601B).
****75 Marks:** Skill Enhancement Course (DCSC) Any One DCSC-601/602/603/604/605.

**Semester-VII**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| EC | EDFE-701 | Perspectives on School Leadership and Management | 1+1+0 | 2 | 10 | 5 | 35 | 50 | 2hrs. |
| | EDFE-702 | Curriculum Planning & Development (textbooks, material development, etc.) – (Stage Specific) | 1+0+1 | 2 | 10 | 5 | 35 | 50 | 2hrs. |
| *Ability Enhancement & Value – Added Courses (Any One) | AEVA-701 A | Art Education (Performing and Visual) and Creative Expressions Exemplar 2 – Theatre | 1+0+1 | 2 | 10 | 5 | 35 | 50 | 2hrs. |
| | AEVA-701 B | Art Education (Performing and Visual) and Creative Expressions Exemplar 3 – Collage | | | | | | | |
| | AEVA-702 | Sports, Nutrition and Fitness | 1+1+0 | 2 | 10 | 5 | 35 | 50 | 2hrs. |
| School Experiences | EDSE-701 | School Based Research Project | 1+1+0 | 2 | - | - | - | 50 | - |
| | EDSE-702 | Internship in Teaching | - | 10 | Internship Assessment* | | | 250 | - |
| **Total Credits** | | | | **20** | **Total Marks** | | | **500** | |

***50 Marks:** Ability Enhancement & Value – Added Courses (Any One) AEVA-701A/701B

**Semester-VIII**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| EC | EDFE-801 | Philosophical & Sociological Perspectives of Education – II | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| | EDFE-802 | Education Policy Analysis | 1+1+0 | 2 | 10 | 5 | 35 | 50 | 2hrs. |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | *EDFE-803 (Any One) | One Elective from the offered courses (Adolescence Education/Art Education/Education for Mental Health/Education for Sustainable Development/Emerging Technologies in Education/Gender Education/ Guidance and Counselling/Peace Education/ Sports and Fitness Education | 3+1+0 | 4 | 25 | 5 | 70 | 100 | 3hrs. |
| Ability Enhancement & Value – Added Courses | AEVA-801 | Yoga and Understanding Self | 1+0+1 | 2 | 10 | 5 | 35 | 50 | 2hrs. |
| | AEVA-802 | Citizenship Education, Sustainability and Envrionmental Education | 1+0+1 | 2 | 10 | 5 | 35 | 50 | 2hrs. |
| School Experiences | EDSE-801 | School Based Research Project | 1+0+1 | 2 | - | - | - | 50 | - |
| | EDSE-802 | School Based Research Project | 1+0+1 | 2 | - | - | - | 50 | - |
| Community Engagement and Service | EDCE-801 | Community Engagement and Service (Adult Education, etc.) | 0+1+1 | 2 | - | - | - | 50 | - |
| **Total Credits** | | | | **20** | **Total marks** | | | **500** | |
| ***100 Marks:** One Elective Course from the offered Courses (EDFE-803) | | | | | | | | | |
| **Cumulative Credits** | | | **176** | | **Course Total Marks** | | | **4400** | |

| Semester | Credits | Marks |
|---|---|---|
| I | 24 | 600 |
| II | 22 | 550 |
| III | 23 | 575 |
| IV | 23 | 575 |
| V | 21 | 525 |
| VI | 23 | 575 |
| VII | 20 | 500 |
| VIII | 20 | 500 |
| | **176** | **4400** |

**Semester-I**
**The student induction programme (SIP)**

| Courses | Paper Code | Course/paper | Periods per Week L+T+P | Credits | Internal/External | | | Max. marks | Exam Duration |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Internal | | External | | |
| | | | | | Th. | Pr. | Ext. | | |
| SIP | SIP | Student Induction programme for Two Week | - | - | - | - | - | - | 4 hrs. Per day |

The student induction programme (SIP) seeks to enable students who come with diverse socioeconomic and linguistic backgrounds and prior learning to adjust to the institutional environment and ethos, help create bonding between students as well as between students and faculty and develop an understanding of the self and society at large. The student induction programme will be organised during the first two weeks of the first semester of the 8-semester ITEP. The activities under the induction programme will include:

i) orientation programme on different aspects of the ITEP and required courses and credit requirements; ii) physical activities like team sports and physical training/exercise sessions designed to inculcate team spirit, group cohesion and bonding as well as physical and mental health;

iii) participation in creative expression activities relating to visual and performing arts like painting, sculpture, pottery, music, dance etc. to develop aesthetic sensibility and creativity;

iv) motivational lectures by eminent people in the society, visits to local areas of cultural and historical importance and institutions such as Balvatikas/Anganwadi Centres, schools and higher education institutions, hospitals, local artisans, adult and lifelong education activities to develop an understanding of the functioning of various institutions, community and society;

v) Familiarising students with the different Departments/Units within the institution and their roles, including visits to laboratories, workshops, facilities for sports etc. in order to acquaint students with the various facilities available in the institution.

# SEMESTER

# I

**EDFE-101: Evolution of Indian Education (EC)**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

The course seeks to develop an understanding among student teachers of the evolution of education in India that would allow student teachers to locate themselves within the larger system of education. The course aims at orienting student teachers to the historical perspective of Indian education including the development and features of education in ancient India such as the Gurukuls, post-Vedic period, during Mauryan and Gupta empires, during colonial era and post-independence period, and future perspectives about education development in India, and progression from Education 1.0 to Education 4.0 etc. This course also provides an overview of the contribution of Indian thinkers to evolve Indian Education system – Savitribai and Jyotiba Phule, Rabindranath Tagore, Gijubhai Badheka, Mahatma Gandhi, Dr. Bhima Rao Ambedkar and others.

**Course Learning Outcomes**

After completion of this course, student teachers will be able to:

- discuss genesis, vision, and evolution of education in ancient India to the contemporary India,
- Enable them to shape their educational perspective to act as an effective teacher.

**UNIT - I**

Ancient Indian Education: Vedic Period

a) Vision, objectives and salient features of Vedic Education System.
b) Teaching and Learning Process.
c) Development of educational institutions: Finances and Management.
d) Famous Educational institutions and Guru-Shishya.
e) Education at the time of Epics: Ramayana and Mahabharata.

**UNIT - II**

Ancient Indian Education: Buddhist and Jain Period

a) Vision, objectives and salient features of Buddhist and Jain Education System.
b) Teaching and Learning Process.
c) Finance and Management of Educational Institutions.
d) Educational Institutions: Nalanda, Taxila, Vikramshila, Vallabhi, Nadia.
e) Famous Guru-Shishya.

**UNIT - III**

Post-Gupta Period to Colonial Period

a) Vision, objectives, brief historical development perspective as well as salient features of Education in India.
b) Teaching and Learning Process.
c) Finance and Management of educational institutions.

**UNIT - IV**

Modern Indian Education

a) Colonial Education in India
b) Woods Despatch, Macaulay Minutes and Westernization of Indian Education
c) Shiksha ka Bhartiyakaran (Indigenous Interventions in Education) (Bird's eye view of their contribution)- Swadeshi and Nationalist attempts of educational reforms with special reference to general contribution of Indian thinkers – Savitribai and Jyotiba Phule, Rabindranath Tagore, Gijubhai Badheka, Mahatma Gandhi, Dr. Bhima Rao Ambedkar and others – to the education systems of India.

Education in Independent India

- Overview of Constitutional values and educational provisions.
- Citizenship Education:

a) Qualities of a good citizen.
b) Education for fundamental rights and duties.

- Overview of 20th Century Committees, Commissions and Policies.
- UEE, RMSA, RTE Act 2009: Overview and impact.
- NEP 2020: vision and implementation for a vibrant India.

**Suggestive Practicum**

- Prepare a report highlighting educational reforms with special reference to school Education in the light of NEP 2020.
- Critically analyze the concept of good citizen from the perspective of education for Democratic citizenship.
- Compare vision, objectives, and salient features of education during different periods.
- Working out a plan to develop awareness, attitude and practices related to Fundamental Rights or fundamental duties or democratic citizenship qualities execute it in the class and write the details in form of a report.
- Sharing of student experiences (in groups) related to Indian constitutional values, help them to reshape their concept and enable them to develop vision, mission and objectives for a school and their plan to accomplish the objectives in form of a group report.
- Analyses of current educational strengths and weaknesses of one's own locality and work out a critical report.
- Visit to places of educational significance and value centers and develop a project report.
- Observation of unity and diversity in a social locality and matching it with unity and diversity in the class and work out a plan for awareness for national-emotional integration or class to develop awareness, attitudes, skills, and participatory values, execute it in the class and report the details.

**Suggestive Mode of Transaction**

- The course content transaction will include the following:
- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group
- discussions, cooperative teaching and team teaching, selections from theoretical readings
- case studies, analyses of educational statistics and personal field engagement with
- educationally marginalized communities and groups, through focus group discussion

- Surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

**Suggestive Mode of Assessment**
The assessment will be based on the tests and assignments.

**Suggestive Reading Materials**
Teachers may suggest books/readings as per the need of the learners and learning content.

**DCBO-101: Basic Concepts of Botany (DSC)**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination: 3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the Course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –
- Know the microscopic structure of cell organelles.
- Disntigusih the basic concepts of prokaryotic and eukaryotic cells and their functioning.
- Classify the different types of higher plants.
- Know the basics of plant physiology.

**UNIT-I**
Cell, difference between Prokaryotic and Eukaryotic cell; structure, chemical composition or protoplasm, cell wall, plasma membrane.
Characterization of Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms

**UNIT-II**

Plant Kingdom, Classification; Bentham & Hooker, Engler & Prantle, John Hutchinson system of classification, Diagnostic features and economic importance of Brassicaceae & Poaceae.

Economic importance of cereals (Wheat), Millets (Perl millet), oil (Mustard), Pulses, Fibres (Cotton) and medicinal plants.

**UNIT-III**

Diversity in plant forms: annual, biennial and perennial; convergence of evolution of tree habit in monocotyledons and di-cotyledons, trees-largest and longest plants.

Structure of flower

Angiosperms: Distinguishing characters, difference between monocotyledons and dicotyledons

**UNIT-IV**

Mendel's laws of Inheritance

Plant Physiology: elementary concept of transpiration, photosynthesis, respiration

**Suggested readings**


- Atherely,.G., Girton, J. R. and McDonald, J. F. 1999. The Science of Genetics Saunders College Publishing, Fort Worth, USA.
- Gupta, P.K. 1999. A Textbook of Cell and Molecular Biology. Rastogi Publications, Meerut.
- Molecular Cell Biology. W.H. Freeman & Co. New York, USA.
- Russel, P. J. 1998. Enetics. The Benjamin/Cummings Publishing Co. Inc., USA.
- Powar C. B. Cell Biology Himalaya Publishing House, 1991
- Singh,V., Pandey, P.C.and Jain, D.K.1998-99. Botany, Rastogi Publications, Meerut.


**DCBO-102: Diversity of Microbes-I (Virus, Bacteria and Algae)**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)

C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –

- Differentiate microscopic to macroscopic view of the plants.
- Distinguish the basic concepts of prokaryotic cell and eukaryotic cell and their functioning.
- Sailent features algae
- Differentiate algal members from different class of the kingdom Algae
- Know the basics of life cycle of different Cyanobacteria

**UNIT-I**

Viruses and Bacteria: Structure, Multiplication, transmission and disease symptoms of viruses; Structure of mycoplasma; Bacteria – structure, nutrition, reproduction and economic importance.

**UNIT -II**

Algae: General characters, occurrence, classification (Fritsch, 1935), Pigment constitution, fine structure of algal plastids, life-cycles, Origin and evolution of sex and thallus in algae. Economic importance of Algae.

**UNIT-III**

General account of Cyanophyceae and Chlorophyceae (Structure, reproduction).
Cyanophyceae: Life Cycle of Nostoc, Anabaena and Oscillatoria
Chlorophyceae: Chlamydomonas Volvox, Oedogonium

**UNIT-IV**

Structure, reproduction and evolutionary significance of following genera:
Xanthophyceae: Vaucheria,
Phaeophyceae: Ectocarpus, Sargassum
Rhodophyceae: Polysiphonia

**Suggested Readings:**


- Smith, GM. 1971. Cryptogamic Botany. Vol. 1 Algae & Fungi. TataMcGraw Hill Publishing Co, New Delhi.
- Sharma, O.P. 1992. Text Book of Thallophytes. McGraw Hill Pub. Co.
- Sharma. P.D. 1991. The Fungi. Rastogi & Co. Meerut.
- Clifton A. 1985. Introduction of the Bacteria. McGraw Hill & Co. New York.
- Singh,V., Pandey, P.C.and Jain, D.K.1998-99. Botany, Rastogi Publications, Meerut.


**PRACTICALS**

**Course Content:**

- Study of representative plants of angiosperms families included in the syllabus.
- Examine and describe briefly the economic importance of the following-Wheat, Musturd, Pea, Cotton.
- Anatomy of primary growth in monocot and dicot by preparing temporary slides
- Demonstrate the transpiration, evolution of oxygen during photosynthesis, aerobic and an aerobic respiration
- Study of the genera included in theory syllabus of Algae by making temporary micro preparations and observation of permanent slides.
- Observation of disease symptoms in host infected by Bacteria, Viruses and Mycoplasma.
- Section cutting of diseased material and identification of the pathogens as per the theory syllabus.
- Maintenance & submission of a record of all the Laboratory activities.

**DCCH-101: General Chemistry-I**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes:** By the end of this course, students will be able to –

- Explain the fundamental principles of atomic structure.
- Demonstrate knowledge of the periodic table
- Analyze the chemical behavior and reactivity of main group elements.
- Apply key concepts of chemical bonding.
- Identify and classify organic compounds
- Demonstrate skills for laborartoy techniques

**UNIT – I**

**Atomic Structure:**

Concept of atom in ancient India, Bohr's theory & its limitations, atomic spectrum of hydrogen atom, de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Postulates of wave mechanics, Time independent Schrödinger's wave equation, well behaved wave function, significance of $\psi$ and $\psi^2$, Quantum mechanical treatment of H- atom, Quantum numbers and their significance, Normalized and orthogonal wave functions, Sign of wave functions, Radial and angular wave functions for hydrogen atom, Radial function plots, radial probability distribution plots, angular distribution curves, Shapes of s, p, and d orbitals.

**UNIT – II**

**Periodicity of Elements:**

s, p, d, f block elements, the long form of periodic table, Detailed discussion of the following properties of the elements, with reference to s & p-block, Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table, Atomic radii (van der Waals), Ionic and crystal radii,

Covalent radii (octahedral and tetrahedral), Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy, Applications of ionization enthalpy, Electron gain enthalpy, trends of electron gain enthalpy, Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffé's electronegativity scales, Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity, Sanderson's electron density ratio.

**UNIT – III**

**Chemistry of main group elements:**

s-Block Elements: General characteristics, diagonal relationships and anomalous behavior of first member of each group, Reactions of alkali and alkaline earth metals with oxygen, hydrogen, nitrogen and water, common features of hydrides, oxides, carbonates, nitrates, sulphates of alkali and alkaline earth metal compounds, complex formation tendency and solutions of alkali metals in liquid ammonia, Comparative study, diagonal relationship, salient features of hydrides, salvation and complexation tendencies including their function in bio-system and introduction to alkyls and aryls.

p-Block Elements: Periodicity in properties of p-block elements with special reference to atomic and ionic radii, ionization energies, electron-affinity, electronegativity, allotropy, inert pair effect, catenation including diagonal relationship, Structure, bonding and properties of hydrides of group 13, oxides of phosphorus and sulphur, oxoacids of phosphorus, halides of silicon and phosphorus, borazine, silicates, silicones.

Chemistry of Noble Gasses: Chemical properties of the noble gasses, chemistry of xenon, structure and bonding in xenon compounds.

**UNIT – IV**

**Basic Concepts of Organic Chemistry**

Structure and Bonding: Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bonding, van der Waals interactions, inclusion compounds, clathrates, charge transfer complexes, resonance, hyper conjugation, aromaticity, inductive and field effects, and hydrogen bonding. Mechanism of Organic Reactions: Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking, Types of reagents – electrophiles and nucleophiles, Types of organic reactions, Energy considerations. Reactive intermediates – Carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples), Assigning formal charges on intermediates and other ionic species, Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).

**Suggested Readings:**


- Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
- Cotton, F.A., Wilkinson, G. & Gaus, P.L. *Basic Inorganic Chemistry*, 3rd ed., Wiley.
- Douglas, B.E., McDaniel, D.H. & Alexander, J.J. *Concepts and Models in InorganicChemistry*, John Wiley & Sons.
- Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. *Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson Education India, 2006.
- Graham Solomon, T.W., Fryhle, C.B. &Dnyder, S.A. *Organic Chemistry*, JohnWiley & Sons (2014).
- McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning IndiaEdition, 2013.
- Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, Orient Longman, NewDelhi (1988).
- Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.
- Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.
- Bahl, A. &Bahl, B.S. *Advanced Organic Chemistry*, S. Chand, 2010.


**Practical-I (Minor)**

**Credit of the Course**: **1**

**Syllabus:**

1. **Basic Laboratory techniques**

- Calibration of Thermometer
  Naphthalene (80-82°C), Acetanilide (113.5-114°C), Urea (132.5-133°C), Distilled Water (100°C)
- Distillation

Simple distillation of ethanol-water mixture using water condenser
Distillation of nitrobenzene and aniline using air condenser

- Crystallization
  Concept of induction of crystallization
  Phthalic acid from hot water (using fluted filter paper and stem less funnel)
  Acetanilide from boiling water
  Naphthalene from ethanol
  Benzoic acid from water
- Decolourisation and crystallization using charcoal
  Decolourisation of brown sugar (sucrose) with animal charcoal using gravity filtration
  Crystallization and decolorization of impure naphthalene (100g of naphthalene mixed with 0.3g of Congo Red using 1g decolorizing carbon) using ethanol.
- Sublimation (simple and Vacuum)
  Camphor, Naphthalene, phthalic acid and Succinic acid.
- Determination of melting point/ boiling points
- Determination of melting point: Naphthalene, Benzoic acid, Urea, Succinic acid, Cinnamic acid, Salicylic acid, Acetanilide, m-Dinitrobenzene p-Dichlorobenzene, Aspirin.
  Determination of boiling points: Ethanol, Cyclohexane, Toluene, Aniline and Nitrobenzene.

2. **Viva-Voce**
3. **Evaluation of record book of experiments performed in semester.**

**DCCH-102: Inorganic Chemistry-I**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –

- Demonstrate an understanding of the periodic trends and properties of d-block elements.
- Reflect upon the principles of coordination chemistry.
- Utilise appropriate chemical nomenclature and notation to describe the composition and structure of inorganic compounds.
- Apply theoretical concepts to predict the behaviour of inorganic compounds in qualitative analysis.

**UNIT-I**

**d- Block Elements-I:**

Chemistry of the elements of the first transition series: electronic configuration and comparative study with respect to atom and ionic radii, oxidation states and ionization potential. Redox potential, oxidation state diagrams on the basis of redox potentials, binary compounds (hydrides, carbides & oxides) and complexes illustrating relative stability of their oxidation states, coordination number and geometry, metallic nature, magnetic properties, catalytic activity, colour and spectral properties of transition metal ions.

**UNIT- II**

**d- Block Elements-II**

Chemistry of the elements of second and third transition series: electronic configuration, general characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behavior, spectral properties and stereochemistry.

**UNIT- III**

**Coordination Chemistry:**

Introduction of coordination compounds ,Werner's theory, nomenclature of coordination compounds, isomerism in coordination compounds, Stereochemistry of complexes with 4 and 6 coordination numbers, Chelate effect, polynuclear complexes, Labile and inert complexes, valence bond theory (inner and outer orbital complexes), electroneutrality principle and back bonding. Crystal field theory, measurement of CFSE, CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of 10 Dq ($\Delta o$, $\Delta t$), Octahedral vs. tetrahedral coordination, tetragonal distortions from octahedral geometry Jahn-Teller theorem, square planar geometry, Qualitative aspect of Ligand field and MO Theory.

**UNIT-IV**

**Oxidation reduction:**

use of redox potential data analysis of redox cycle, redox stability in water-Frost Latimer and Pourbaix diagram, Principles involved in the extraction of the element.

**Suggested Readings:**


- Huheey, J. E.; Keiter, E.A. &Keiter, R.L. Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed., HarperCollins 1993, Pearson,2006.
- Sharpe, A.G. Inorganic Chemistry, 4th Indian Reprint (Pearson Education) 2005.
- Lee, J.D. Concise Inorganic Chemistry 5th Ed., John Wiley and sons 2008.
- Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications, 1962.
- Powell, P. Principles of Organometallic Chemistry, Chapman and Hall, 1988.
- Miessler, G. L. &Tarr, D.A. Inorganic Chemistry 4th Ed., Pearson, 2010.
- Crabtree, R. H., The Organometallic Chemistry of the Transition Metals, New York, NY: John Wiley, 2000
- Atkins, P.W. & Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014
- Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
- Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009


**Practical-I (Major)**

**Credit of the Course**: 1

**Syllabus:**

1. **Inorganic Chemistry**

   Inorganic qualitative analysis: Semi-micro qualitative analysis of given mixtures-not more than six ionic species having three anions and three cations (including interfering)) out of the following:

Cations: $NH_4^+$, $Pb^{2+}$, $Ag^+$, $Bi^{3+}$, $Cu^{2+}$, $Cd^{2+}$, $Sn^{2+}$, $Fe^{3+}$, $Al^{3+}$, $Co^{2+}$, $Cr^{3+}$, $Ni^{2+}$, $Mn^{2+}$, $Zn^{2+}$,$Ba^{2+}$, $Sr^{2+,}$ $Ca^{2+}$
Anions: $CO_3^{2-}$, $S^{2-}$, $SO_3^{2-}$, $S_2O_3^{2-}$, $NO_3^-$, $CH_3COO^-$, $Cl^-$, $Br^-$, $I^-$, $NO_2^-$,$SO_4^{2-}$, $PO_4^{3-}$, $BO_3^{3-}$, $C_2O_4^{2}$, $F^-$(Spot tests should be carried out wherever feasible)

**2. Viva-Voce**
**3. Evaluation of record book of experiments performed in semester.**

**DCMA-101: Calculus-I**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Calculus-I (Minor/Major)**

**Course Learning Outcomes:** After completion of this course the student will be able to:

- Sketch curves in a plane using its mathematical properties in the different coordinate
  - Systems of reference.
- Apply derivatives in Optimization, Social sciences, Physics and Life sciences etc.
- Compute curvature and may find the asymptotes by inspection
- Compute area of surfaces of revolution and the volume of solids by integrating over cross-sectional areas.

**UNIT-I**

Tangents and Normal's, Sub tangent and subnormal (Cartesian and polar forms), Derivative of an arc (Cartesian and Polar form), Pedal equations, Curvature: Curvature of Circle, Radius of curvature formula for pedal equation and radius of curvature for polar equations.

**UNIT-II**

Partial differentiation: Homogeneous function, Euler's theorem and its applications, Total differential coefficient, change of variables (Polar to Cartesian and vice-versa), maxima and minima of functions of two variables including the Lagrange's method of undetermined multipliers.

**UNIT-III**

Asymptotes: Asymptotes of the general algebraic curves, Asymptotes parallel to the axis, Oblique asymptotes, Asymptotes by inspection. Envelops and Evolutes.

**UNIT-IV**

Multiple points and curve tracing: Concavity and Convexity of a curve, Test of concavity, convexity and point of inflexion, multiple point, Necessary conditions for the existence of a double point, Procedure for tracing the curve in Cartesian, Parametric and Polar forms.

**Recommended Readings:**

- Thomas' Calculus: G.B. Thomas, 2018, Pearson
- Calculus Vol. 1 and 2, T.M. Apostol, 2007, Wiley.
- Calculus: M. Spivak, 2006, Cambridge.
- Calculus: J. Stewart , 2012, Cengage Learning.

**DCMA-102: Real Analysis-I**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: After completion of this course the student will be able to:

- Understand many properties of the real line and learn to define sequence in terms of functions from N to a subset of R.
- Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
- Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.

**UNIT-I**

Real Number System: Set theory, Algebraic and order properties of R, Absolute value of a real number; Bounded above and bounded below sets, Supremum and Infimum of a nonempty subset of R.

**UNIT-II**

Properties of R: The completeness property of R, Archimedean property, Density of rational numbers in R, Definition and types of intervals, Nested intervals property; Neighborhood of a point in R , Open and closed sets in R.

**UNIT-III**

Sequences in R: Convergent sequence, Limit of a sequence, Bounded sequence, Limit theorems, Monotone sequences, Monotone convergence theorem, Subsequences, Bolzano-Weierstrass theorem for sequences, Limit superior and limit inferior for bounded sequence, Cauchy sequence, Cauchy's convergence criterion.

**UNIT-IV**

Infinite Series: Convergence and divergence of infinite series of real numbers, Necessary condition for convergence, Cauchy criterion for convergence; Tests for convergence of positive term series: Integral test, Basic comparison test, Limit comparison test, D'Alembert's ratio test, Cauchy's nth root test; Alternating series, Leibniz test, Absolute and conditional convergence.

**Recommended Readings:**


- Bartle, Robert G., & Sherbert, Donald R. (2015), Introduction to Real Analysis (4th ed.). Wiley India Edition. New Delhi.
- Bilodeau, Gerald G., Thie, Paul R., & Keough, G. E. (2010). An Introduction to Analysis (2nd ed.). Jones and Bartlett India Pvt. Ltd. Student Edition. Reprinted 2015.
- Denlinger, Charles G. (2011). Elements of Real Analysis. Jones and Bartlett India Pvt. Ltd. Student Edition. Reprinted 2015.


**DCPY-101: Mechanics**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes:** The student teachers will be able to:

- Acquaint with the key concepts of mechanics.
- Appreciate the applications of the concepts in real life situations.
- Solve the problems based on mechanics.
- Apply the theory in execution of practicals.

**UNIT-I**

Frames of Reference: Inertial and non-inertial frames, Galilean transformations, pseudo forces, transformations of displacement, velocity and acceleration in rotating frames, Coriolis force and its applications, Focault's pendulum, Centre of mass and laboratory reference frames.
System of particles: centre of mass, equation of motion, system of variable mass, single stage and multistage rocket, energy and momentum conservation, concepts of elastic and inelastic collisions.

**UNIT-II**

Central forces: Motion under a central force, conservation of angular momentum, Kepler's laws, different types of orbits i.e. circular, elliptical, parabolic and hyperbolic orbits, Fields and potentials, gravitational field and potential due to spherical bodies, Gauss and Poisson equations for gravitational potential, gravitational self-energy.

**UNIT-III**

Rigid body dynamics: angular momentum, equations of rotational motion, conservation theorems for energy, momentum and angular momentum, rigid body, degrees of freedom, moment of inertia and their products, inertial coefficients, Euler's equations, principal moments and axes, product of inertia.

**UNIT-IV**

Elasticity: Young's modulus, bulk modulus and modulus of rigidity, Poisson's ratio, relation among elastic constants, Theory of bending of beams and cantilever, Torsion of a cylinder, Bending moments and Shearing forces, determination of Y by bending of beam method, Searle's two bar experiment, determination of modulus of rigidity by static and dynamic methods.

**Suggested Readings:**

- E.M. Purcell, Editor, Berkeley Physics Course, Vol. 1, Mechanics, McGraw Hill.
- R.P. Feynmann, R.B. Lighton, M. Sands, TheFeynmann Lectures in Physics, Vol. 1. B.I. publications, Bombay, Delhi, Calcutta, Madras.
- Mechanics of particles, Rigid Bodies and Continuous Media (In Hindi) by Kalra, Bhandari and Kak
- Mechanics: J.C. Upadhyay
- Mechanics: R.K.Shukla and Anchal Srivastava.
- Concepts of Physics: A Beiser

**Practical**

- To study the variation of power transfer to different loads by a DC source and verify maximum power transfer theorem. (Plotting of the graph).
- Conversion of a Galvanometer into a ammeter (Range 1A).
- Conversion of a Galvanometer into a Voltmeter (Range 1V).
- To determine dispersive power of prism.
- Study of bending of a cantilever or a beam.
- Study of torsion of a wire (static and dynamic methods.)
- Study of flow of liquids through capillaries.
- Determination of surface tension of a liquid by different methods.
- Study of viscosity of a fluid by different methods.
- To determine internal resistance of Lechlanche Cell using a Potentiometer.

- To study the characteristics of a semiconductor junction diode and to determine forward and reverse resistances.
- To study the random decay and determine the decay constant by statistical method.
- To determine Poisson's ratio of rubber tube.
- To determine young's modules by bending of beam.
- To determine Y, η and σ by Searle's method.
- To determine modulus of rigidity of material of wire using Maxwell's needle.
- To determine modulus of rigidity by statical vertical method.
- To determine modulus of rigidity by statical horizontal method.

**Suggested Readings:**


- Concept of Quantum Mechanics; Beiser (McGraw Hill)
- Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.
- A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11th Edn, 2011,Kitab Mahal
- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal1985, Vani Pub


**DCPY-102: Mathematical Physics**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** Student teachers will be able to:

- Discuss the concepts of curvilinear coordinates.
- Explain the concept of tensor analysis.
- Identify different types of matrices.
- Apply the differential equation to solve the problem.
- Apply the concepts of special functions and Fourier analysis.

**UNIT-I**

Scalars and Vectors: dot products, triple vector product, gradient of scalar field and its geometrical interpretation, divergence and curl of a vector field, line, surface and volume integral, Flux of a vector field, Gauss divergence theorem, Green's theorem and Stokes theorem. Functions of two and three variables, Partial derivatives, geometrical interpretation of total differential of a function of two and three variables, Higher order derivatives and their applications**.**

**UNIT-II**

Curvilinear Coordinates: Orthogonal curvilinear coordinates, Orthogonal Curvilinear Coordinates, Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems.

Tensor Analysis: Introduction to tensors, Transformation of Coordinates, covariant, contravariant and mixede tensors, Symmetric and Anti-symmetric Tensors, Quotient Law of Tensors, Sum, Difference and Product of Tensors, Christoffel Symbols of First and Second Kind and their Transformation Laws, Covariant Derivative, Tensor Form of Gradient, Divergence and Curl.

**UNIT-III**

Differential Equations: Second Order Differential Equations and their Solution, Singular Points of Second Order Differential Equations and their Importance, Legendre, Bessel, Hermite and Laguerre Differential Equations. Special Functions: Legendre, Hermite and Laguerre Polynomials, Rodrigues' Formulae, Generating Functions, Recurrence Relations, Orthogonality, Series Expansion of a Function in terms of a complete set of Legendre Functions, Bessel Functions, Generating Function, Recurrence Formulas.

**UNIT-IV**

Fourier Series: Dirichlet Conditions, Kronecker's Method for Computation of Fourier Coefficients, Even and Odd Functions, Sine and Cosine Series, Fourier analysis of square wave, saw-tooth wave, half wave and full wave rectifier wave forms, Fourier theorem, Summing of Infinite Series Term-by-Term Differentiation and Integration of a Fourier Series.

**Suggested Readings:**

- Mathematical Methods for Physicists: G.B. Arfken and H.J. Weber
- Mathematical Physics: A.K. Ghatak, L.C. Goyal and S.J. Chua
- Mathematical Physics: P. K. Chattopadhyay
- Applied Mathematics for Engineers and Physicists: L.A. Pipes and L.R. Harvill
- Advanced Engineering Mathematics: Erwin Kreyszig
- Theory and Problems of Vector Analysis (Schaum's Outline Series): M.R. Spiegel

**DCZO-101: Biology of Non-Chordates**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| Distribution Marks for the course | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** After successfully completing the course, the students will be able to:

- Develop an understanding of the characters used to classify besides being able to differentiate the organisms belonging to different taxa.
- Have hands on experience of materials demonstrating the diversity of protists and non-chordates.
- Know the process of physiological mechanisms are used in very diverse organisms

**UNIT-I**

a) Outline classification of Protozoa up to order, General structural organization of Amoeba, Euglena and Plasmodium
b) Habit, habitat, structure, nutrition, osmoregulation and reproduction of Paramecium
c) Locomotion in Protozoans: pseudopodial, cilliary and flagellar.
d) Nutrition in Protozoa; Reproduction in Protozoa

**UNIT-II**

a) Outline classification of Porifera and coelenterates up to order.
b) Habit, habitat, morphology, internal structure, reproduction of *Sycon*, Canal system and skeleton in sponges
c) Habit, habitat, morphology, internal structure, nutrition and reproduction of *Obelia*, Polymorphism in coelenterates, coral reefs
d) Outline classification of Platyhelminthes and Nemetehelminthes up to order.
e) Habit, habitat, morphology, internal structure, nutrition and reproduction and life cycle of *Fasciola* and *Ascaris*, Parasitic adaptations in Helminthes

**UNIT- III**

a) Outline classification of Annelida and Arthropoda up to order
b) Habit, habitat, morphology, internal structure, nutrition, respiration, circulation, excreation, nervous system and reproduction of *Hirudineria* and *Palaemon*
c) *Paripatus*: structure and affinities.
d) Mouth parts and feeding habits of insects

**UNIT-IV**

a) Outline classification of Molllusca and Echinodermata up to order
b) Habit, habitat, structure, nutrition, respiration, blood vascular system, excretion, nervous system and reproduction of *Pila* and *Asterious*
c) Torsion in Gastropoda.
d) Larval forms of Echinodermata

**Practical:**

- Study of museum specimens with respect to levels and patterns of organization biosystematics, biodiversity, adaptations, development stages, population dynamics, ecological implications:
- **Porifera***: Sycon, Spongilla, Euplectella, Leucosolenia, Hylonema, Hippospongia, Euspongia;*
- **Coeleterata**: *Hydra, Tubularia, Millepora, Physalia, Porpita, Vellela, Aurelia, Tubipora, Alcyonium, Metridium, Pennatula, Grantia, Fungia, Gorgonia.*
- **Helminthes***: Fasciola, Taenia solium, Planaria, Ascaris, Ancyclostoma;*

- **Annelida**: *Nereis, Heteroneresis, Aphrodite, Chaetoptrus, Arenicola, Pheretima, Hirudinaria*
- **Arthropoda**: *Palaemon, Eupagurus, Scolopendra, Apis, Peripatus.*
- **Mollusca**: *Chiton, Pila, Aplysia, Helix, Dentalium, Mytilus, Pinctada, Unio, Sepia, Loligo Octopus:*
- **Echinodermata**: *Antedon, Holothuria, Cucumaria, Astropecten, Asterias, Echinus*
- Study of Permanent slides *Paramecium*, *Paramecium* in Conjugation, *Paramecium* binary fission, *Euglena*, *Vorticella*, *Sycon* L.S., *Sycon* T.S. , *Hydra* L.S., *Hydra* T.S, Cercaria larva, Metacercaria, Miracidium larva, Sporocyst larva, Redia larva, *Ascaris* male and female T.S., T.S. through pharynx region, Gizzard and intestinal region of Earthworm, T.S. through buccal cavity of *Hirudinaria*, Zoea, Metazoea, Nauplius, Mysis, T.S. of gill of *Unio*. T.S. of the shell & mantle of *Unio*, Glochidium larva of *Unio*.
- Dissections and / or its demonstration through Charts / Models / Video / CD / digital alternative etc and / or preparation of working models of the different systems of the following animals.
- Earthworm: Alimentary canal, Nervous system and Reproductive system.
- Leech Alimentary canal
- Cockroach : Mouthparts Digestive system, nervous system
- Prawn: Nervous system
- *Pila*: Nervous system
- Microscopic preparation or their observation of the following.
  *Paramecium, Euglena*, Sponge spicules, gemmules, *Obelia, Hydra*, parapodium of *Nereis*, statocyst of Prawn, mouth parts of *Cockroach*, radula of *Pila*, gill of *Unio*.
- Culture of *Paramecium, Euglena* and *Amoeba.*

**Note:**

- Use of animals for dissection is subject to the conditions that these are not banned under the Wildlife Protection Act or any other legislation.
- Students are required to submit the following during examination:
  a. One assignment on the instrument/ technique about its principle, working, precautions and applications; and /or reagents / solutions preparation.
  b. Report on study of animals from their natural habitat from their local surroundings etc.

**Suggested Readings:**


- Modem Textbook of Zoology Invertebrates by R.L. Kotpal –(Rastogi Publication, Meerut 10th Revised Edition )
- Invertebrate Zoology series (Protozoa of Echinnodermata) by R.L. Kotpal - – (Rastogi Publication , Meerut)
- Invertebrate Zoology by E.L. Jordan and P.S. Verma – S. Chand & Co., Delhi
- Invertebrate Zoology by J.K. Dhami and P.S. Dhami – S. Chand & Co., Delhi
- A textbook of Invertebrate Zoology by S.N. Prasad – (Kitab Mahal, Allahabad)
- Life of Invertebrate Zoology by Russel and Hunter – (Macmillan)
- Invertebrate Zoology by R.D. Barnes :- (W.B. Saunders, Philadelphia)
- A manual of Zoology Vol. I by Ekambernatha Ayyar (Vishwnathan,Madras)
- The invertebrate series of L.H. Hyman – ( McGraw Hill)
- A student's textbook of Zoology by Adma Sedgwick VoI .I, II & III (Central Book Depot, Allahabad)
- A textbook of Zoology VoI. I by Parkar and Haswell – (Macmillan)
- Lower non chordate, Dr VS Pawar, Hindi Edition, College book centre, Chaura Rasta, Jaipur
- Higher non Chordate, Dr VS Pawar, Hindi Edition, College book centre, Chaura Rasta, Jaipur
- Animal taxonomy and evolution, Dr VS Pawar, Hindi Edition, College book centre, Chaura Rasta, Jaipur


**DCZO-102: Animal Taxonomy and Biodiversity**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** After successfully completing the course, the students will be able to:

- To know and appriicate non-chordate diversity
- Distinguish structural and functional diversity in non-chordates and their naming techniques
- Comprehen relationship amongst various non-chordate groups

**UNIT-I**

a) Principles of Animal Taxonomy: Rules of nomenclature
b) Principles of classification - Theories of biological classification and their history
c) The concept of species, sub species, Polytypic species
d) Intraspecific categories.
e) Trends in Biosystematics-Chemotaxonomy, Cytotaxonomy and Molecular Taxonomy

**UNIT-II**

a) Taxonomic characters – different kinds, origin of reproductive isolation
b) Taxonomic keys-Different kinds of Taxonomic keys, their merits and demerits
c) International Code of Zoological Nomenclature (ICZN): Formation of Scientific names of various Taxa.
d) A study of the classification of invertebrates with distinguishing features and examples of various subdivisions

**UNIT-III**

a) Biodiversity- Concept, principles and Types of biodiversity
b) Major biodiversity areas of the world: Biodiversity hotspots
c) Indian Biodiversity Areas : Zones of faunal distribution
d) Major protected areas and their importance.
e) Causes for the loss of biodiversity

**UNIT-IV**

a) Biodiversity indices. Measuring -species richness, species evenness Simpson's diversity Index and Shannon's diversity index

b) Biodiversity act of India, Biodiversity hot spots in India, Hope Spot Concept, UNESCO heritage sites (Kaziranga National Park etc.)
c) IUCN Threatened Categories, Rare, endangered or threatened species and their Conservation strategies
d) Biodiversity conservation methods (*Ex-situ* and *In-situ*)

**Practical:**

- Composition/ assessment of taxonomic diversity in a habitat (grassland, arid land, wetland, forest etc.)
- Write characteristics of different biomes and mark their location on world map.
- Mark major rivers of India on a map; visit a river or pond and submit a write up.
- Make a diagram of zones of Sea / Lake, write down its characteristics
- Understand about coral reef, their types, structure and their mark their location in world and India's map
- Mark major Ecozones of India on India's map-visit a desert, grass land or rain forest submit a write up
- Mark important sanctuaries and national parks of Rajasthan on map, and write details of any three emphasizing the fauna and their conservation.
- Visit any National Park, Sanctuary, Forest area or nearby protected area to study biodiversity and live animals of the area. Also, to prepare and submit report of the field trip.
- Spotting: Photographs/Models of wild animals of Rajasthan to study their distinguish features, classification, Habit & Habitat and conservation status.

**Note:**
Those Institutions which are already having Zoology Museums should not procure Museum Specimens now onwards and should use charts/slides/models/photographs and digital alternatives in case of need. Those new institutions which are not having Zoology Museum in their Department should provide learning related to zoological specimens with the help of charts/slides/models/photographs and digital alternatives and visit of students to already established museums

**Suggested Readings:**


- R.C. Brusca & amp; G.J. Brusca. Invertebrates. Sinauer Associates Inc. Publishers
- D.T. Anderson (Editor). Invertebrate Zoology. Oxford University Press.
- V.C. Kapoor. Theory and Practice of Animal Taxonomy and Biodiversity.
- D.N. Pandey. Animal Taxonomy.
- E. Mayer & Peter D. Ash lock. Principles of Systematic Zoology.
- E. Mayer. Elements of Taxonomy
- R.L. Kotpal. Textbook of Invertebrate Structure and Functions. Rastogi Publication
- Robert D. Barnes. Invertebrate Zoology: A Functional Evolutionary Approach
- E.J.W. Barrington. Invertebrate structure and Function
- T.C. Narendran. An Introduction to Taxonomy
- G.G. Simpson. Principles of Animal Taxonomy. Oxford IBH Publishing Company
- B.N.H.S. – The Preservation of Wild Life in India.
- B.N.H.S. - Wild Animals of India.
- B.K. Tikadar. Threatened animals of India
- Darwin. C. Origin of Species, Watts & Co. 5 and 6 Johnson’s Courts, Fleet Street, E.C. 4, London.
- E.O.Wilson: Biodiversity, Academic press, Washington
- E.O.Wilson: The diversity of life (the college edition), W W Northern & co.
- M. Kato: The biology of diversity. Springer


**DCBO-101: Basic Concepts of Botany (DSC)**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –

- Distinguish microscopic to macroscopic view of the plants.
- Know the basic concepts of prokaryotic cell and eukaryotic cell and their functioning.
- Sailent features of algae
- Differentiate algal members from different class of the kingdom Algae
- know the basics of life cycle of different Cyanobacteria

**UNIT-I**

Cell, difference between Prokaryotic and Eukaryotic cell; structure, chemical composition or protoplasm, cell wall, plasma membrane.
Characterization of Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms

**UNIT-II**

Plant Kingdom, Classification; Bentham & Hooker, Engler & Prantle, John Hutchinson system of classification, Diagnostic features and economic importance of Brassicaceae & Poaceae.
Economic importance of cereals (Wheat), Millets (Perl millet), oil (Mustard), Pulses, Fibres (Cotton) and medicinal plants.

**UNIT-III**

Diversity in plant forms: annual, biennial and perennial; convergence of evolution of tree habit in monocotyledons and di-cotyledons, trees-largest and longest plants.
Structure of flower
Angiosperms: Distinguishing characters, difference between monocotyledons and dicotyledons

**UNIT-IV**

Mendel's laws of Inheritance
Plant Physiology: elementary concept of transpiration, photosynthesis, respiration

**Suggested readings**


- Atherely,.G., Girton, J. R. and McDonald, J. F. 1999. The Science of Genetics Saunders College Publishing, Fort Worth, USA.
- Gupta, P.K. 1999. A Textbook of Cell and Molecular Biology. Rastogi Publications, Meerut.
- Molecular Cell Biology. W.H. Freeman & Co. New York, USA.
- Russel, P. J. 1998. enetics. The Benjamin/Cummings Publishing Co. Inc., USA.
- Powar C. B. Cell Biology Himalaya Publishing House, 1991
- Singh,V., Pandey, P.C.and Jain, D.K.1998-99. Botany, Rastogi Publications, Meerut.


**PRACTICAL**

**Course Content:**

- Study of representative plants of angiosperms families included in the syllabus.
- Examine and describe briefly the economic importance of the following-Wheat, Musturd, Pea, Cotton.
- Anatomy of primary growth in monocot and dicot by preparing temporary slides
- Demonstrate the transpiration, evolution of oxygen during photosynthesis, aerobic and an aerobic respiration
- Study of the genera included in theory syllabus of Algae by making temporary micro preparations and observation of permanent slides.
- Observation of disease symptoms in host infected by Bacteria,Bryophytes, Pteridophyta.
- Maintenance & submission of a record of all the Laboratory activities.

## DCCH-101: General Chemistry-I

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

Course Learning Outcomes: By the end of this course, students will be able to –

- Explain the fundamental principles of atomic structure.
- Demonstrate knowledge of the periodic table
- Analyze the chemical behavior and reactivity of main group elements.
- Apply key concepts of chemical bonding.
- Identify and classify organic compounds
- Demonstrate skills for laborartoy techniques

**UNIT – I**

**Atomic Structure:**

Concept of atom in ancient India, Bohr's theory & its limitations, atomic spectrum of hydrogen atom, de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Postulates of wave mechanics, Time independent Schrödinger's wave equation, well behaved wave function, significance of $\psi$ and $\psi^2$, Quantum mechanical treatment of H- atom, Quantum numbers and their significance, Normalized and orthogonal wave functions, Sign of wave functions, Radial and angular wave functions for hydrogen atom, Radial function plots, radial probability distribution plots, angular distribution curves, Shapes of s, p, and d orbitals.

**UNIT – II**

**Periodicity of Elements:**

s, p, d, f block elements, the long form of periodic table, Detailed discussion of the following properties of the elements, with reference to s & p-block, Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table, Atomic radii (van der Waals), Ionic and crystal radii, Covalent radii (octahedral and tetrahedral), Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy, Applications of ionization enthalpy, Electron gain enthalpy, trends of electron gain enthalpy, Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffé's electronegativity scales, Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity, Sanderson's electron density ratio.

**UNIT – III**

**Chemistry of main group elements:**

s-Block Elements: General characteristics, diagonal relationships and anomalous behavior of first member of each group, Reactions of alkali and alkaline earth metals with oxygen, hydrogen, nitrogen and water, common features of hydrides, oxides, carbonates, nitrates, sulphates of alkali and alkaline earth metal compounds, complex formation tendency and solutions of alkali metals in liquid ammonia, Comparative study, diagonal relationship, salient features of hydrides, salvation and complexation tendencies including their function in bio-system and introduction to alkyls and aryls.

p-Block Elements: Periodicity in properties of p-block elements with special reference to atomic and ionic radii, ionization energies, electron-affinity, electronegativity, allotropy, inert pair effect, catenation including diagonal relationship, Structure, bonding and properties of hydrides of group 13, oxides of phosphorus and sulphur, oxoacids of phosphorus, halides of silicon and phosphorus, borazine, silicates, silicones.

Chemistry of Noble Gasses: Chemical properties of the noble gasses, chemistry of xenon, structure and bonding in xenon compounds.

**UNIT – IV**

**Basic Concepts of Organic Chemistry**

Structure and Bonding: Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bonding, van der Waals interactions, inclusion compounds, clathrates, charge transfer complexes, resonance, hyper conjugation, aromaticity, inductive and field effects, and hydrogen bonding. Mechanism of Organic Reactions: Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking, Types of reagents – electrophiles and nucleophiles, Types of organic reactions, Energy considerations. Reactive intermediates – Carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples), Assigning formal charges on intermediates and other ionic species, Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).

**Suggested Readings:**

- Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
- Cotton, F.A., Wilkinson, G. & Gaus, P.L. *Basic Inorganic Chemistry*, 3rd ed., Wiley.
- Douglas, B.E., McDaniel, D.H. & Alexander, J.J. *Concepts and Models in InorganicChemistry*, John Wiley & Sons.
- Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. *Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson Education India, 2006.
- Graham Solomon, T.W., Fryhle, C.B. &Dnyder, S.A. *Organic Chemistry*, JohnWiley & Sons (2014).
- McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning IndiaEdition, 2013.
- Sykes, P. *A Guidebook to Mechanism in Organic Chemistry,* Orient Longman, NewDelhi (1988).
- Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.
- Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.
- Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry,* S. Chand, 2010.

**Practical-I (Minor)**

**Credit of the Course**: **1**

**Syllabus:**

**1. Basic Laboratory techniques**

- Calibration of Thermometer
  Naphthalene (80-82°C), Acetanilide (113.5-114°C), Urea (132.5-133°C), Distilled Water (100°C)
- Distillation
  Simple distillation of ethanol-water mixture using water condenser
  Distillation of nitrobenzene and aniline using air condenser
- Crystallization
  Concept of induction of crystallization
  Phthalic acid from hot water (using fluted filter paper and stem less funnel)
  Acetanilide from boiling water
  Naphthalene from ethanol
  Benzoic acid from water
- Decolourisation and crystallization using charcoal
  Decolourisation of brown sugar (sucrose) with animal charcoal using gravity filtration
  Crystallization and decolorization of impure naphthalene (100g of naphthalene mixed with 0.3g of Congo Red using 1g decolorizing carbon) using ethanol.
- Sublimation (simple and Vacuum)
  Camphor, Naphthalene, phthalic acid and Succinic acid.
- Determination of melting point/ boiling points
- Determination of melting point: Naphthalene, Benzoic acid, Urea, Succinic acid, Cinnamic acid, Salicylic acid, Acetanilide, m-Dinitrobenzene p-Dichlorobenzene, Aspirin.
  Determination of boiling points: Ethanol, Cyclohexane, Toluene, Aniline and Nitrobenzene.

**2. Viva-Voce**

**3. Evaluation of record book of experiments performed in semester.**

**DCMA-101: Calculus-I**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.

- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Calculus-I (Minor/Major)**

**Course Learning Outcomes:** After completion of this course the student will be able to:

i) Sketch curves in a plane using its mathematical properties in the different coordinate systems of reference.
ii) Apply derivatives in Optimization, Social sciences, Physics and Life sciences etc.
iii) Compute curvature and may find the asymptotes by inspection
Compute area of surfaces of revolution and the volume of solids by integrating over cross-sectional areas.

**UNIT-I**

Tangents and Normal's, Sub tangent and subnormal (Cartesian and polar forms), Derivative of an arc (Cartesian and Polar form), Pedal equations, Curvature: Curvature of Circle, Radius of curvature formula for pedal equation and radius of curvature for polar equations.

**UNIT-II**

Partial differentiation: Homogeneous function, Euler's theorem and its applications, Total differential coefficient, change of variables (Polar to Cartesian and vice-versa), maxima and minima of functions of two variables including the Lagrange's method of undetermined multipliers.

**UNIT-III**

Asymptotes: Asymptotes of the general algebraic curves, Asymptotes parallel to the axis, Oblique asymptotes, Asymptotes by inspection. Envelops and Evolutes.

**UNIT-IV**

Multiple points and curve tracing: Concavity and Convexity of a curve, Test of concavity, convexity and point of inflexion, Multiple point, Necessary conditions for the existence of a double point, Procedure for tracing the curve in Cartesian, Parametric and Polar forms.

**Recommended Readings:**


- Thomas' Calculus: G.B. Thomas, 2018, Pearson
- Calculus Vol. 1 and 2, T.M. Apostol, 2007, Wiley.
- Calculus: M. Spivak, 2006, Cambridge.
- Calculus: J. Stewart, 2012, Cengage Learning.

**DCPY-101: Mechanics**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes:** The student teachers will be able to:

- Acquaint with the key concepts of mechanics.
- Appreciate the applications of the concepts in real life situations.
- Solve the problems based on mechanics.
- Apply the theory in execution of practicals.

**UNIT-I**

Frames of Reference: Inertial and non-inertial frames, Galilean transformations, pseudo forces, transformations of displacement, velocity and acceleration in rotating frames, Coriolis force and its applications, Focault's pendulum, Centre of mass and laboratory reference frames.

System of particles: centre of mass, equation of motion, system of variable mass, single stage and multistage rocket, energy and momentum conservation, concepts of elastic and inelastic collisions.

**UNIT-II**

Central forces: Motion under a central force, conservation of angular momentum, Kepler's laws, different types of orbits i.e. circular, elliptical, parabolic and hyperbolic orbits, Fields and potentials, gravitational field and potential due to spherical bodies, Gauss and Poisson equations for gravitational potential, gravitational self-energy.

**UNIT-III**

Rigid body dynamics: angular momentum, equations of rotational motion, conservation theorems for energy, momentum and angular momentum, rigid body, degrees of freedom, moment of inertia and their products, inertial coefficients, Euler's equations, principal moments and axes, product of inertia.

**UNIT-IV**

Elasticity: Young's modulus, bulk modulus and modulus of rigidity, Poisson's ratio, relation among elastic constants, Theory of bending of beams and cantilever, Torsion of a cylinder, Bending moments and Shearing forces, determination of Y by bending of beam method, Searle's two bar experiment, determination of modulus of rigidity by static and dynamic methods.

**Suggested Readings:**

- E.M. Purcell, Editor, Berkeley Physics Course, Vol. 1, Mechanics, McGraw Hill.
- R.P. Feynmann, R.B. Lighton, M. Sands, TheFeynmann Lectures in Physics, Vol. 1. B.I. publications, Bombay, Delhi, Calcutta, Madras.
- Mechanics of particles, Rigid Bodies and Continuous Media (In Hindi) by Kalra, Bhandari and Kak
- Mechanics: J.C. Upadhyay
- Mechanics :R.K.Shukla and Anchal Srivastava.
- Concepts of Physics: A Beiser

**Practical**

- Study of bending of a cantilever or a beam.
- Study of torsion of a wire (static and dynamic methods.)
- Study of flow of liquids through capillaries.
- Determination of surface tension of a liquid by different methods.
- Study of viscosity of a fluid by different methods.
- To study the random decay and determine the decay constant by statistical method.
- To determine Poisson's ratio of rubber tube.
- To determine young's modules by bending of beam.
- To determine Y, η and σ by Searle's method.
- To determine modulus of rigidity of material of wire using Maxwell's needle.
- To determine modulus of rigidity by statical vertical method.
- To determine modulus of rigidity by statical horizontal method.

**Suggested Readings:**

- Concept of Quantum Mechanics; Beiser (McGraw Hill)
- Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.
- A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11th Edn, 2011,Kitab Mahal
- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal1985, Vani Pub

**DCZO-101: Biology of Non-Chordates**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.

- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| Distribution Marks for the course | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** After successfully completing the course, the students will be able to:

- Develop an understanding of the characters used to classify besides being able to differentiate the organisms belonging to different taxa.
- Familiarize with hands on experience of materials demonstrating the diversity of protists and non-chordates.
- Know the process of physiological mechanisms are used in very diverse organisms

**UNIT-I**

a) Outline classification of Protozoa up to order, General structural organization of Amoeba, Euglena and Plasmodium
b) Habit, habitat, structure, nutrition, osmoregulation and reproduction of Paramecium
c) Locomotion in Protozoans: pseudopodial, cilliary and flagellar.
d) Nutrition in Protozoa; Reproduction in Protozoa

**UNIT-II**

a) Outline classification of Porifera and coelenterates up to order.
b) Habit, habitat, morphology, internal structure, reproduction of *Sycon*, Canal system and skeleton in sponges
c) Habit, habitat, morphology, internal structure, nutrition and reproduction of *Obelia*, Polymorphism in coelenterates, coral reefs
d) Outline classification of Platyhelminthes and Nemetehelminthes up to order.
e) Habit, habitat, morphology, internal structure, nutrition and reproduction and life cycle of *Fasciola* and *Ascaris*, Parasitic adaptations in Helminthes

**UNIT- III**

a) Outline classification of Annelida and Arthropoda up to order
b) Habit, habitat, morphology, internal structure, nutrition, respiration, circulation, excreation, nervous system and reproduction of *Hirudineria* and *Palaemon*
c) *Paripatus*: structure and affinities.
d) Mouth parts and feeding habits of insects

**UNIT-IV**

a) Outline classification of Molllusca and Echinodermata up to order
b) Habit, habitat, structure, nutrition, respiration, blood vascular system, excretion, nervous system and reproduction of *Pila* and *Asterious*
c) Torsion in Gastropoda.
d) Larval forms of Echinodermata

**Practical:**

- Study of museum specimens with respect to levels and patterns of organization biosystematics, biodiversity, adaptations, development stages, population dynamics, ecological implications:
- **Porifera***: Sycon, Spongilla, Euplectella, Leucosolenia, Hylonema, Hippospongia, Euspongia;*

- **Coeleterata**: *Hydra, Tubularia, Millepora, Physalia, Porpita, Vellela, Aurelia, Tubipora, Alcyonium, Metridium, Pennatula, Grantia, Fungia, Gorgonia.*
- **Helminthes***: Fasciola, Taenia solium, Planaria, Ascaris, Ancyclostoma;*
- **Annelida**: *Nereis, Heteroneresis, Aphrodite, Chaetoptrus, Arenicola, Pheretima, Hirudinaria*
- **Arthropoda**: *Palaemon, Eupagurus, Scolopendra, Apis, Peripatus.*
- **Mollusca**: *Chiton, Pila, Aplysia, Helix, Dentalium, Mytilus, Pinctada, Unio, Sepia, Loligo Octopus:*
- **Echinodermata**: *Antedon, Holothuria, Cucumaria, Astropecten, Asterias, Echinus*
- Study of Permanent slides *Paramecium*, *Paramecium* in Conjugation, *Paramecium* binary fission, *Euglena*, *Vorticella*, *Sycon* L.S., *Sycon* T.S. , *Hydra* L.S., *Hydra* T.S, Cercaria larva, Metacercaria, Miracidium larva, Sporocyst larva, Redia larva, *Ascaris* male and female T.S., T.S. through pharynx region, Gizzard and intestinal region of Earthworm, T.S. through buccal cavity of *Hirudinaria*, Zoea, Metazoea, Nauplius, Mysis, T.S. of gill of *Unio*. T.S. of the shell & mantle of *Unio*, Glochidium larva of *Unio*.
- Dissections and / or its demonstration through Charts / Models / Video / CD / digital alternative etc and / or preparation of working models of the different systems of the following animals.
- Earthworm: Alimentary canal, Nervous system and Reproductive system.
- Leech Alimentary canal
- Cockroach : Mouthparts Digestive system, nervous system
- Prawn: Nervous system
- *Pila*: Nervous system
- Microscopic preparation or their observation of the following.
  *Paramecium, Euglena*, Sponge spicules, gemmules, *Obelia, Hydra*, parapodium of *Nereis*, statocyst of Prawn, mouth parts of *Cockroach*, radula of *Pila*, gill of *Unio*.
- Culture of *Paramecium, Euglena* and *Amoeba.*

**Note:**

- Use of animals for dissection is subject to the conditions that these are not banned under the Wildlife Protection Act or any other legislation.
- Students are required to submit the following during examination:
  c. One assignment on the instrument/ technique about its principle, working, precautions and applications; and /or reagents / solutions preparation.
  d. Report on study of animals from their natural habitat from their local surroundings etc.

**Suggested Readings:**


- Modem Textbook of Zoology Invertebrates by R.L. Kotpal –(Rastogi Publication, Meerut 10th Revised Edition )
- Invertebrate Zoology series (Protozoa of Echinnodermata) by R.L. Kotpal - – (Rastogi Publication , Meerut)
- Invertebrate Zoology by E.L. Jordan and P.S. Verma – S. Chand & Co., Delhi
- Invertebrate Zoology by J.K. Dhami and P.S. Dhami – S. Chand & Co., Delhi
- A textbook of Invertebrate Zoology by S.N. Prasad – (Kitab Mahal, Allahabad)
- Life of Invertebrate Zoology by Russel and Hunter – (Macmillan)
- Invertebrate Zoology by R.D. Barnes :- (W.B. Saunders, Philadelphia)
- A manual of Zoology Vol. I by Ekambernatha Ayyar (Vishwnathan,Madras)
- The invertebrate series of L.H. Hyman – ( McGraw Hill)
- A student's textbook of Zoology by Adma Sedgwick VoI .I, II & III (Central Book Depot, Allahabad)
- A textbook of Zoology VoI. I by Parkar and Haswell – (Macmillan)
- Lower non chordate, Dr VS Pawar, Hindi Edition, College book centre, Chaura Rasta, Jaipur
- Higher non Chordate, Dr VS Pawar, Hindi Edition, College book centre, Chaura Rasta, Jaipur
- Animal taxonomy and evolution, Dr VS Pawar, Hindi Edition, College book centre, Chaura Rasta, Jaipur

**AEVA-101: Lanuguage I (As per the 8th Schedule of Constitution of India)**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc. (at the end of 15th Week).

**About the Course:**

Language has undeniable links with all kinds of learning. Language enables an individual to understand new concepts, exchange ideas and communicate thoughts with fellow beings. To appreciate fully the role of language in education, one must begin to develop a holistic perspective on language. Language needs to be examined in a multi-dimensional space, giving due importance to its structural, literary, sociological, cultural, psychological, and aesthetic aspects. The National Education Policy 2020 envisages imparting language skills as part of holistic education. It lays thrust on the need to enhance linguistic skills for better cognitive development and the development of a rounded personality of the learners. This course aims at enabling student teachers to enhance their ability to listen, speak, read, write and demonstrate linguistic skills in an effective manner. Linguistic skills - listening, speaking, reading, writing, speaking effectively - are fundamental to constructing knowledge in all academic disciplines, and. participating effectively in the world of work and creating sense in the everyday life. Through this course, the students will be able to enhance proficiency in reading with comprehension, understanding, thinking, and conceptualizing. The course seeks to enhance critical thinking abilities and effective communication skills of student teachers. The course involves hands-on activities and practical sessions that help student teachers develop and use linguistic skills in a variety of situations.

**Course Learning Outcomes**

After completing the course, the student teachers will be able to:

- Demonstrate knowledge and capacity for effective listening, speaking, reading, writing and critical thinking.
- Recognize the link between language and cognition and using linguistic knowledge and skills for effective communication of ideas and thoughts.
- Build inter-personal relationships and enhance social skills.

**UNIT – I**

Understanding Language, Communication and Cognition

a) Language, communication, and cognition; Definitions and functions of language. Types of communication, Language, culture and society, Bi-/Multilingualism in India, Language learning, translation, formal and informal communication, verbal and non- verbal communication, gestures language skills (listening, speaking, reading, & writing) and the new-age technologies. Language as a means of communication and language as a medium of cognition.
b) Nature and process of communication: principles, Definition, and types; Language: Definition, characteristics, functions; Language and society: language variation, language and dialect, language policy and language planning, language standardization; Multilingualism in Indian context, Language as a means of communication and language as a medium of cognition.
c) The process of communication, barriers to communication, written and oral communication, the story of human communication from early times to new age; Language variation, Multilingualism.
d) Context of communication, the role of decoder, face to face interaction, turn taking, conversation, politeness principles, opening and closing, regional variation, social variation, the standard language.

**UNIT – II**

Understanding Grammar

a) Classification of speech sounds and letters, stress, pitch, tone, intonation and juncture, parts of speech, identification of morphemes, word formation processes, sentences-simple, complex, and compound, semantics and pragmatics, lexical semantics, speech acts.
b) Production of speech sounds in languages; Suprasegmentals: stress, pitch, tone, intonation; Word formation processes; Sentence formation, semantics, and pragmatics.
c) Identification of morphemes, word formation processes; Sentence formation, vocabulary formation; Pragmatics and speech acts.
d) Sound production in the language; Coining new words, Speech acts.

**UNIT - III**

Reading Skills

a) Reading comprehension, types of reading, text, meaning and context, reading as an interactive process; strategies for making student's active readers and developing critical reading skills; Understanding denotative and connotative aspects of a text, Vocabulary development through reading.
b) Features that make texts complex, reading as an interactive process; Strategies for making students active readers and developing critical reading skills; Understanding denotative and connotative aspects of a text, Vocabulary development through reading.
c) Reading discipline-based texts; vocabulary development

Speaking skills

a) Speaking to learn and learning to speak; situational conversations and role plays; tasks/activities for developing speaking (speech, elocution, discussion, debate, storytelling, illustrations).
b) Activities for developing speaking, role play; the impact of culture on speaking.
c) Presentation and speaking skills; Practicing narrative skills; Body language, voice, and pronunciation; Creating interest and establishing a relationship with the audience.

Writing Skills

a) Speech versus writing; Types of writing; writing for specific purposes (essays, letters, and reports).
b) Language and style of Writing; Dealing with New Words (Academic Vocabulary Building).
c) Summarizing and Paraphrasing techniques.

**UNIT - IV**

Listening Skills

a) Why listening is important; kinds of listening; Listening strategies.
b) Need for modelling good listening behaviour; Listening across the curriculum, note taking.
c) Listening Comprehensions and Recorded speeches/texts; Understanding of various accents.

Academic writing

a) Academic writing components; development of academic language; Activities to develop academic writing skills.

b) Developing Critical, analytical, and interpretive thinking skills.
c) Learning to analyze.

Critical thinking

a) Enhancing Critical thinking abilities; Critical Interpretation, Questioning and Challenging your Beliefs and Values; developing ideas and evaluating an argument.
b) Observing a problem, describing the problem, framing the problem, comparing, and evaluating a problem.

**Suggestive Practicum**

- How do you interpret every day and reflect what you read? Prepare a report.
- Analyze a recorded video from the perspective of voice and pronunciation and write a report.
- Observing, describing and frame a problem and evaluating it.

**Suggestive Mode of Transaction**

Teaching this course will involve a mix of interactive lectures, tutorials, and practical involves such as discussion, role plays, projects, simulations, workshops, and language-awareness activities. The teaching intends deeper approaches to learning involving in- class room discussion, developing the critical thinking/ problem solving abilities among the students and will also focus on situations where in our daily lives the one would be performing tasks that involve a natural integration of language skills. The students are expected to read assigned chapters/ articles before the session and the course requires active participation from the students.

**Suggestive Mode of Assessment**

The assessment of the learner will be primarily based on the assessment of both linguistic and communicative skills using a battery of tests and test types, group work and projects.

**Suggestive Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning content.

**AEVA-102 A: Art Education (Performing and Visual) and Creative Expressions**
**Exemplar 1 - Puppetry**

| | |
|---|---|
| Credits: 1L+0T+1P | Marks 50 |
| Contact hours per week: 3 | C1+C2=5+10 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 5 | 1hr | 20 |
| Internal Test (C2) | 10 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)

C2: Performance activities as per Suggestive Mode of Assessment (before End-Semester examination).

**About the Course**

Engagement with various forms of art as self-expression and need to develop sensibility to appreciate them has been an important concern in educational theory and practice. This concern is premised on the claim that forms of self-expression contribute immensely to the development of cognitive, affective, and psycho-motor dimensions among children, as well as that through one or another art form, children come to explore ways of expressing themselves. Further, it is also the case that critical appreciation of art enables children to form judgments of a very special kind, namely, aesthetic judgment. This enables students as they grow into adults to have focused attention on making sense of and appreciating cultural productions.

Children enjoy artwork a lot. They explore and find meaning in artwork. Their psycho-motor skills get developed through art. The huge element of socialization is acquired through different forms of art. They get to know each other and understand each other and make friends through art. They develop their peer group through getting involved in art forms. Learning to work with others is also achieved through art. It gives them space to think independently, create and reflect. It is one space where all the three are involved- hand, head, and heart.

Therefore, students will need to bring an element of art in practices that they engage in. To be able to do this, they need an appreciation of art in general, familiarity with one art form, and basic skills and capabilities to be creative and artful. Additionally, they should be familiar with some critical debates in art education, even if their work is in other subject areas.

To this end in the first semester students will do one course that aims to help them recognize and appreciate the importance of aesthetic judgment, develop familiarity with an art form and basic skills to be creative and artful in their expressions. Skills develop from practice, therefore hands-on training in doing art will be emphasized in this course. This course aims to help students develop a habit of performing skillful activities that are essentially aesthetic and artful which is expected to contribute to other educational practices that they develop in other courses in the programme. Therefore, this course will explicitly relate this skill to activities that practitioners of education engage in, like teaching, development of teaching-learning material, and content of other subject areas wherever possible.

**Puppetry**

Puppetry is an integrated art form, which takes into its fold everything from fine arts to performance. Puppetry is one of the oldest forms of performing art. Puppetry has evolved over the years into a sophisticated form of art. The journey was very interesting with a lot of ups and downs. There are thousands of forms of puppetry from simple finger puppets to highly complex puppets played by more than 3 people.

In puppetry there are two main aspects. One the designing and creating of puppets and the other playing or performing puppetry. These two skills are different. Designing needs a lot of thinking, visualization, and technical skills while performance needs high level communication skills. Hence, together they make a consolidated a high range of skills. In this course, students are exposed to different forms of puppets and puppetry. There will be a discussion around the forms and the aesthetic sense of puppetry. Later the students are encouraged to prepare, design and create puppets. They then prepare script and play the puppets.

This creation of the puppets together in small groups with a lot of discussions and give and take helps the students develop working together skills and conceptual understanding.

**Course Learning Outcomes**

After completion of this course, student teachers will be able to:

- articulate the importance of aesthetics and art in secondary education,
- demonstrate their familiarity with and appreciation of puppetry,
- design puppets,
- practice and create a short puppetry show.

**UNIT - I**

Importance of Aesthetics and Art education

Basic idea of aesthetics and art, aesthetic dimensions manifested in human life. Examples of art, to engage students in identifying aesthetic aspects of daily life, develop aesthetic judgment and gain familiarity with the role of art in education. Introduction to three aspects of art in education: The value of art itself and its use as an instrument in

education; moral dimensions of works of art and the controversial distinction between the value of popular art and High art.

**UNIT - II**

Designing Puppets

Puppetry, its history in Indian perspective and specifically about how puppets work. Imagination for designing puppets, visualizing use of puppets and technicalities of designing puppets. These will be learnt by designing puppets. Learning and constructing finger puppets and move towards small shapes through papers, like Fish, birds, rat - Design masks, flat masks, and masks with dimensions. Designing puppets with old newspapers and colour papers. Decorate it and design it in such a way that it can be played, performed. Preparation of costumes and other accessories.

**UNIT - III**

Performing the puppets

Performance of puppetry and the level of communication skills for creating an engaging story and performing it with the help of puppets. Relating performance/activity in the educational context. Learning through performance of students with puppets individually, in pairs and into small groups based on skits developed. Consolidation and reflection on performance. Different aspects of puppet making and their use in class room processes. Adapting individual and group exercises in classroom situation.

**Pedagogy**

The Pedagogy is basically hand-on training. More emphasis is given to experiential learning. Students do things and through doing learn about art and its connection to education. The process takes them through different forms of art- fine arts, playing with colours, costume designing, facial make -up, script writing, music, and performance.

**Suggestive Mode of Assessment as per following Table:**

| Mode of Assessment | | |
|---|---|---|
| S.N. | Topics | Session flow |
| 1 | Aesthetics and art, art in everyday life | Based on their experience |
| 2 | Importance of art. Appreciation of art. | Discussion |
| 3 | Art for art sake. Art with social responsibility. Art for social change | Debate |
| 4 | The world of puppetry. Different forms of puppetry. | Presentations |
| 5 | History of puppetry | Lecture |
| 6 | Preparation- finger puppets | Hands on |
| 7 | Preparation of masks | Hands on |
| 8 | Preparing puppets | Hands on |
| 9 | Performing individually | Practice |
| 10 | Performing in pairs | Practice |
| 11 | Performing in groups – 3, 4, 5. | Practice |
| 12 | Assignments | Written |

**Suggestive Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning content.

**AEVA-103: Understanding India (Indian Ethos and Knowledge Systems)**

| | |
|---|---|
| Credits: 1L+1T+0P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.

- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

At a time when the world finds itself deep in dynamism, led by technological innovations and environmental changes, there is a need for an inward-looking approach to building the young minds of a country. By looking inwards, one not only finds a sociological belongingness but also a spiritual and intellectual rooting in these changing times. The course provides an overview of India's heritage and knowledge traditions across key themes of economy, society, polity, law, environment, culture, ethics, science & technology, and philosophy. It places special emphasis on the application of these knowledge traditions, helping students to noy only know and appreciate India's heritage and knowledge traditions but also to independently evaluate them through a multidisciplinary lens. This evaluation would produce valuable lessons for obtaining transferable and 21st-century skills. The course requires no pre-requisite knowledge or understanding. Spread over two years, the course will establish foundational knowledge and build upon it. It will allow students to have a basic understanding of the traditions of India and how it has evolved over the years. The course is designed to enable student teachers to outline and interpret the processes and events of the formation & evolution of knowledge of India through a multidisciplinary lens; to evaluate the diverse traditions of India to distinguish its achievements and limitations, and to develop and articulate an ethics-based education rooted in Indian thought to their students in the classroom context.

**Course Learning Outcomes**

After the completion of the course, students will be able to:

- recognize the vast corpus of knowledge traditions of India, while developing an appreciation for it,
- apply their acquired research and critical thinking skills in multidisciplinary themes,
- Summarize and pass on their learnings to their students of different Indian traditions in an easily digestible manner.

**UNIT - I**

Introduction to the Knowledge of India and Culture - Art and Literature

A. Definition & scope; Relevance of this knowledge.
B. Need to revisit our ancient knowledge, traditions, and culture.
C. Fine arts (traditional art forms, contemporary arts, arts & spirituality, arts and Identity, and art and globalization);
D. Performing Arts (Indian dance systems, traditional Indian pieces of music, visual arts, folk arts, etc.,).

E. Literature (Sanskrit literature, religious literature, Indian poetry, folk literature, Indian fiction, Sangam literature etc.)

**UNIT - II**

Polity and Law

A. Kingship & types of government (oligarchies, republics); Local administration (village administration);
B. Basis of Law: Dharma & its sources; Criminal Justice: police, jails, and punishments; Lessons from Chanakyaniti; Lessons for modern-day India: Towards a tradition-driven equitable and just polity and law system.

Economy

Overview of the Indian Economy from the Stone Age to the Guptas: The new culture of Urbanization (including castes, guilds, and other economic institutions; Harappan civilization economy; growth of agriculture and proliferation of new occupations; growth of writing);

A. Internal & external trade and commerce, including trade routes, Indo-roman contacts, and maritime trade of South India; Temple economy.
B. Land ownership - land grants & property rights, land revenue systems.
C. Understanding Arthashastra: Ideas & Criticism; Locating relevance of ancient Indian economic thought in modern-day Indian Economy.

**UNIT - III**

Environment & Health

A. Understanding Equilibrium between Society & Environment: Society's perceptions of natural resources like forests, land, water, and animals.
B. Sustainable architecture & urban planning; Solving today's environmental challenges (best practices from indigenous knowledge, community-led efforts, etc.).
C. India's Health Tradition: Ayurveda, Siddha, Ashtavaidya, Unani, and other schools of thought; Lessons from Sushruta Samhita and Charaka Samhita;
D. Mental health in ancient India: towards time-tested concepts of mental wellness (concept of mind, dhyana, mind-body relationship, Ayurveda, yoga darshan, atman, etc.)

**Suggestive Practicum**

The modes of curriculum transaction will include lectures, Tutorials, and Practicum.

- Practicum will include organization of day trips that help student teachers watch events relating to visual and performing art; activities that enable student teachers to identify and record through photos, videos, etc. the elements of ancient architecture still existing in the city around them; organization of Individual and group presentations based on themes such as Polity, Law and Economy etc., organization of a 'Knowledge of India' day in the institution to celebrate the culture (food, clothes, etc.) that they would have been explored in lectures and tutorials; interactions with family members, elders, neighbors, and other members of society about the evolution of local systems and economy etc.

**Suggestive Mode of Transaction**

- Lectures will include learner-driven participatory sessions, and Guest lectures through experts and practitioners, such as fine arts and performing arts practitioners along with contemporary poets & writers of Indian literature.
- Tutorials will include Screening of documentaries and films followed by a discussion; Learner-driven discussions in the form of focus group discussions (FGDs), Socratic Discussions, etc.; Debate/discussion can be organized to explain India's Vaad tradition; discuss on how some of the ancient methods of teaching are relevant in today's time; discussions that help Identify ethical dilemmas in daily lives and understanding the importance of ancient ethics and values to resolve them.

**Suggestive Mode of Assessment**

The approaches to learning assessment will include, for example:

- Supporting the curiosity and interest of student teachers in the selected themes through a multi-modal approach, including regular assessments and actionable feedback that enable learners to outline and

interpret the processes and events of the formation & evolution of knowledge of India through a multidisciplinary lens.

- Enabling the student teachers to demonstrate critical analysis and independent thinking of the processes and events in the formulation & evolution of different traditions that help student teachers evaluate the diverse traditions of India to distinguish its achievements and limitations.
- Use of first-hand or second-hand experiences that enable student-teachers to develop and articulate an ethics-based education rooted in Indian thought to their students in the classroom context.

**Suggestive Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning content.

# SEMESTER

# II

**DCBO-201: Diversity of Microbes II (Fungi & Lichen)**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –

1. Know microscopic to macroscopic view of the plants.
2. Understand the basic concepts of prokaryotic cell and eukaryotic cell and their functioning.
3. Silent features of algae
4. Differentiate algal members from different class of the kingdom Algae
5. Understand the basics of life cycle of different Cyanobacteria

**UNIT-I**

Fungi: General characters, occurrence, classification (Alexopolus and Mims, 1979; G. C. Ainswort,1986), Types of mycelia, structure of fungal cell, fungal flagella.

**UNIT-II**

Nutrition and economic importance of fungi, Structure reproduction and life history of
Mastigomycotina – Albugo, Synchytrium

**UNIT-III**

Structure reproduction and life history of Ascomycotina – Saccharomyces, Peziza
Basidiomycotina – Puccinia, Agaricus, Ustilago

**UNIT-IV**

Structure reproduction and life history of Deuteromycotina – Alternaria, Cercospora, Colletotrichum, Host-parasite interaction, Control of plant diseases.
General account and economic importance of Lichens

**Suggested Readings:**


- Smith, GM. 1971. Cryptogamic Botany. Vol. 1 Algae & Fungi. TataMcGraw Hill Publishing Co, New Delhi.
- Sharma, O.P. 1992. Text Book of Thallophytes. McGraw Hill Pub. Co.
- Sharma. P.D. 1991. The Fungi. Rastogi & Co. Meerut.
- Dube. H.C. 1990. An Introduction to Fungi. Vikas Pub. House Pvt. Ltd.Delhi.
- Singh,V., Pandey, P.C.and Jain, D.K.1998-99. Botany, Rastogi Publications, Meerut.


## DCBO-202: Diversity of Cryptogams (Bryophytes and Pteridophytes)

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Coure Learning Outcomes**: By the end of this course, students will be able to –

1. Know the General characters, distribution, and origin of the land habit in plants.
2. Recongzine the Concept of alternation of generations in Bryophytes
3. Appreciate the life history of Hepaticopsida, Anthoceropsida and Bryopsida.
4. Understand the General characters, distribution, classification of Pteridophytes
5. Famalirize the Concept of fossils and fossilization processes

### UNIT-I

General characters, habit and habitat, range of thallus structures, reproduction (Vegetative and sexual reproduction) distribution of Bryophytes, classification of Bryophytes.

Origin and Evolutionary trends in thallus and sporophyte development of Bryophytes, Alternation of generations and Economic importance of Bryophytes.

**UNIT-II**

Structure, reproduction, and evolutionary significance of following genera:
Hepaticopsida – Riccia and Marchantia
Anthocerotopsida – Anthoceros
Bryopsida – Funaria

**UNIT-III**

General characters, distribution, classification, stelar evolution, heterospory and origin of seed habit, and life cycles in pteridophytes.
Structure, reproduction and evolutionary significance of the following genera:
Psilotum; Lycopodium,

**UNIT-IV**

Structure, reproduction and evolutionary significance of the following genera:
Equisetum; Selaginella; Pteris and Marsilea

**Suggested Readings:**


- Sharma, O.P. 1992. Text Book of Thallophytes. McGraw Hill Pub. Co.
- Smith, GM. 1971. Cryptogamic Botany. Vol-II Bryophytes and Pterido- phytes. Tata McGraw Hill Pub. Co. New Delhi.
- Puri, P. 1980. Bryophyta. Atma Ram & Sons Delhi
- Singh,V., Pandey, P.C.and Jain, D.K.1998-99. Botany, Rastogi Publications, Meerut.


**DCBO-203: Plant Cell Biology**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –

1. Prcess of structural organization of cells.
2. Famalirize with the structure and functions of different organelles in the cell.
3. Recongize the concept of cell division, mutations and chromosomal aberrations.

**UNIT-I**

Prokaryotic and Eukaryotic cell structure; Ultra structure and functions of different cell organelles; Cell wall, Plasma membrane, Golgi Complex, endoplasmic reticulum, Lysosomes, Ribosomes, Peroxisomes, Vacuoles, Mitochondria, Chloroplast, Nucleus.

**UNIT-II**

Chromosome organization; Structure/Morphology, centromere and telomere; specialized types of chromosomes; Sex chromosomes, Lampbrush and Polytene chromosome.
Cell division; Cell cycle and Mitosis and meiosis.

**UNIT-III**

Genetic Material: DNA as genetic material (Griffith's transformation experiment and Hershey and Chase blender experiment); structural aspects- structure of DNA (Watson and Crick model) various forms of DNA;
Structure and function of different types of RNA, nucleosides and nucleotides.

**UNIT-IV**

Replication of DNA; DNA protein interaction; nucleosome model; Satellite and repetitive DNA, genetic code; Extra nuclear genetic material: mitochondrial and plastid DNA, plasmid.

**Suggested readings**


- Alberts, B., Bray, D., J., Raff, M., Roberts, K and Watson, I. D. 2001. Molecular Biology of Cell Garland, publishing Co. Inc., New York, USA.
- Atherely,.G., Girton, J. R. and McDonald, J. F. 1999. The Science of Genetics Saunders College Publishing, Fort Worth, USA.
- Gupta, P.K. 1999. A Textbook of Cell and Molecular Biology. Rastogi Publications, Meerut.
- Kleinsmith, L. J. and Kish. V.M. 1995, Principles of Cell and Molecular Biology (3nd edition). Harper Collins College Publishers, New York, USA.
- Lodish, H., Berk, A., Aipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology. W.H. Freeman & Co. New York, USA.
- Russel, P. J. 1998. enetics. The Benjamin/Cummings Publishing Co. Inc., USA.
- Powar C. B. Cell Biology Himalaya Publishing House, 1991


**PRACTICAL**

**Course Content:**

- Study of the genera included in Theory syllabus of Fungi by making temporary micro preparations and observation of permanent slides.
- Observation of disease symptoms in host infected by Fungi.
- Section cutting of diseased material and identification of the pathogens as per the theory syllabus.
- Study of morphology, anatomy and reproductive structures of genera included in Bryophytes and Pteridophytes by making temporary micro preparations and observation of permanent slides.
- Study of crustose, foliose & fruticose Lichens.
- Study of cell structure from Onion, *Hydrilla* and *Spirogyra*.
- Study of cyclosis in *Tradescantia* spp.
- Study of plastid for pigment distribution in *Lycopersicom*, *Cassia* and *Capsicum*.
- Study of electron microphotographs of eukaryotic cells for various cell organelles.
- Study of electron microphotographs of virus, bacteria and eukaryotic cells for comparative study of cellular organization.
- Study of different stages of mitosis and meiosis in root-tip cells and flower buds respectively of onion
- Maintenance & submission of a record of all the Laboratory activities.

**DCCH-201: Inorganic Chemistry-II**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to

1. Demonstrate the ability to analyze electronic spectra of transition metal complexes.
2. Apply principles of reaction kinetics to determine reaction mechanisms and rate laws.
3. Reflect upon role of transition metals in biological systems.
4. Reflects upon chemistry of various types of Inorganic polymers
5. Identify organic compounds on the basis of qualitative analysis
6. Demonstrate experimental aspects of theories of chemical kinetics, viscocity and surface tension.

**UNIT-I**

Electronic Spectra of Transition Metal Complexes: Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series, Orgel and Tanabe-Sugano diagrams for $d^1$ to $d^9$states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion. Calculations of Dq, B and β parameters, charge transfer spectra, spectroscopic method of assignment of absolute configuration in optically active metal chelates and their stereochemical information.

**UNIT-II**

Reaction Kinetics and Mechanism:
Introduction to inorganic reaction mechanisms, Substitution reactions in square planar complexes, Trans- effect, theories of trans effect, Mechanism of nucleophilic substitution in square planar complexes, Thermodynamic and Kinetic stability, Kinetics of octahedral substitution, Ligand field effects and reaction rates, Mechanism of substitution in octahedral complexes.

**UNIT-III**

Bioinorganic Chemistry: Metal ions present in biological systems, classification of elements according to their action in biological system, Geochemical effect on the distribution of metals, Sodium / K-pump, carbonic anhydrase and carboxypeptidase, Excess and deficiency of some trace metals, Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine, Iron and its application in bio-systems, Haemoglobin; Storage and transfer of iron.

**UNIT-IV**

Inorganic Polymers: Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications silicones and siloxanes, Borazines, silicates, phosphazenes and polysulphates.

**Suggested Readings:**


1. Huheey, J. E.; Keiter, E.A. &Keiter, R.L. Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed., Harper Collins 1993, Pearson,2006.
2. Sharpe, A.G. Inorganic Chemistry, 4th Indian Reprint (Pearson Education) 2005.
3. Lee, J.D. Concise Inorganic Chemistry 5th Ed., John Wiley and sons 2008
4. Miessler, G. L. &Tarr, D.A. Inorganic Chemistry 4th Ed., Pearson, 2010
5. S.J. Lippard and J.M. Berg, Principles of Bioinorganic Chemistry, University Science Books.
6. F.A.Cotton and G Wilkinson, Advanced Inorganic Chemistry.
7. D.F.Shriver and P.W. Atkins, Inorganic Chemistry.
8. R.Sarkar and NityanandSaha, General and Inorganic Chemistry (Hon. Consultind Editor).
9. James E. Mark, H.R. Allcock and Robert West, Inorganic Polymers ($2^{nd}$ Edn.).
10. M.F.Lappert and G.J. Leigh, Developments in Inorganic Polymer Chemistry


**DCCH-202: Organic Chemistry-I**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes:** By the end of this course, students will be able to –

1. Reflect upon understanding of reactions of haloalkenes, haloarens and oxygen containing functional group.
2. Demonstrate ability to explain fundamental electronic structure and bonding in carbonyl compounds.
3. Propose plausible mechanisms for the reactions under study.

**UNIT-I**

**Chemistry of Halogenated Hydrocarbons:**

Alkyl halides: Methods of preparation, nucleophilic substitution reactions – $S_N1$, $S_N2$ and $S_Ni$ mechanisms with stereochemical aspects and effect of solvent, nucleophilic substitution vs. elimination. Aryl halides: Preparation, including preparation from diazonium salts, Nucleophilic aromatic substitution, SNAr, Benzyne mechanism, Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

**UNIT - II**

**Alcohols, Phenols, Ethers & Epoxides**

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouvaelt-Blanc Reduction, Preparation and properties of glycols: Oxidation by periodic acid and lead tetraacetate, Pinacol-Pinacolone rearrangement Phenols: Preparation and properties, Acidity and factors effecting it, Ring substitution reactions, Reimer–Tiemann, Kolbe's–Schmidt, Fries and Claisen rearrangements with mechanism, Ethers and Epoxides: Preparation and reactions with acids, Reactions of epoxides with alcohols, ammonia derivatives and $LiAlH_4$.

**UNIT - III**

**Carbonyl Compounds:**

Structure, reactivity and preparation, Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism, Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisan-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann and Benzil-Benzilic acid rearrangements, haloform, Baeyer Villiger oxidation and α- substitution reactions, oxidations and reductions (Clemmensen, Wolff-Kishner, $LiAlH_4$, $NaBH_4$, MPV, PDC and PGC), Addition reactions of unsaturated carbonyl compounds: Michael addition.

Organic Synthesis via Enolates: Acidity of α-hydrogens, Synthesis of ethyl acetoacetate by Claisen condensation and Synthesis of diethylmalonate, Keto-enol tautomerism in ethyl acetoacetate, Synthetic applications of ethyl acetoacetate and diethylmalonate, Alkylation of 1,3-dithianes.

**UNIT-IV**

**Carboxylic Acid & Derivatives:**

Preparation, physical properties and reactions of mono carboxylic acids, Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids: succinic/phthalic, lactic, malic, tartaric, citric, maleic and fumaric acids; Preparation and reactions of acid chlorides, anhydrides, esters and amides, Comparative study of nucleophilic sustitution at acyl group -Mechanism of acidic and alkaline hydrolysis of esters, Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann- bromamide degradation and Curtius rearrangement..

**Suggested Readings:**


1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education)
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. Pearson Education).
3. Graham Solomons, T.W. Organic Chemistry, John Wiley & Sons,Inc.
4. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. CengageLearning India Edition, 2013
5. Acheson, R.M. Introduction to the Chemistry of Heterocyclic compounds, John Wiley & Sons (1976).


**DCCH-203: Physical Chemistry-I**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes:** By the end of this course, students will be able to –

1. Analyze and apply fundamental principles of thermodynamics to solve complex chemical and physical problems
2. Describe and predict the rates of chemical reactions.
3. Demonstrate a deep understanding of phase equilibrium and apply this knowledge to real-world systems.
4. Discuss the principles and applications of nuclear chemistry.
5. Develop critical thinking skills to evaluate and apply thermodynamic and kinetic concepts to practical scenarios, fostering a strong foundation for further studies in chemistry and related disciplines.

## UNIT I

**Chemical Thermodynamics:**

Thermochemistry: Heats of reactions, standard states, enthalpy of formation of molecules and ions, enthalpy of combustion and its applications, calculation of bond energy, bond dissociation energy, resonance energy from thermochemical data, effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions, Adiabatic flame temperature, explosion temperature.

Thermodynamics- Concept of entropy, statement of the second law of thermodynamics, Carnot cycle, Calculation of entropy change for reversible and irreversible processes (for ideal gases), Free Energy Functions, Gibbs and Helmholtz energy, variation of S, G, A with T, V, P, Free energy change and spontaneity (for ideal gases), Relation between Joule- Thomson coefficient and other thermodynamic parameters, inversion temperature, Gibbs-Helmholtz equation, Maxwell relations, thermodynamic equation of state, Statement of third law, unattainability of absolute zero, calculation of absolute entropy of molecules, concept of residual entropy, calculation of absolute entropy of solid, liquid and gases, Reaction isotherm and reaction isochore, Clausius-Claperyron equation and applications.Partial molar quantities, dependence of thermodynamic parameters on composition; Gibbs-Duhem equation, chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases.

## UNIT II

**Chemical Kinetics and Catalysis:**

Chemical Kinetics- Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions up to second order reactions, experimental methods of the

determination of rate laws, kinetics of complex reactions (integrated rate expressions up to first order only): (i) Opposing reactions (ii) parallel reactions (iii) consecutive reactions and their differential rate equations (steady-state approximation in reaction mechanisms) (iv) chain reactions, Temperature dependence of reaction rates, Arrhenius equation, activation energy, Collision theory of reaction rates, Lindemann mechanism, qualitative treatment of the theory of absolute reaction rate.

Catalysis- Types of catalyst, specificity and selectivity, mechanisms of catalyzed reactions at solid surfaces, effect of particle size and efficiency of nanoparticles as catalysts, Enzyme catalysis, Michaelis-Menten mechanism, acid-base catalysis.

**UNIT III**

**Phase Equilibrium:** Concept of phases, components and degrees of freedom, derivation of Gibbs Phase Rule for nonreactive and reactive systems, Clausius-Clapeyron equation and its applications to solid- liquid, liquid-vapour and solid-vapour equilibria, phase diagram for one component systems, with applications. Phase diagrams for systems of solid-liquid equilibria involving eutectic, congruent and incongruent melting points, solid solutions, three component systems, water-chloroform-acetic acid system, triangular plots. Binary solutions: Gibbs-Duhem-Margules equation, its derivation and applications to fractional distillation of binary miscible liquids (ideal and non ideal), azeotropes, lever rule, partial miscibility of liquids, CST, miscible pairs, steam distillation, Nernst distribution law: its derivation and application.

**UNIT IV**

**Nuclear and Radiochemistry:**

Elementary idea of the nucleus, nuclear forces, packing fraction, mass defect and binding energy, nuclear fission and fusion reactions, calculation of Q - values of nuclear reactions, liquid drop and shell models of nucleus, theory of radioactivity, G. M. counter, half-life period, average life, radioactive disintegration, radioactive steady state, group displacement law, radioactive series, separation and identification of isotopes, application of radioactivity and radioactive tracers.

**Suggested Readings:**


1. A TextBook of Physical Chemistry; A.S. Negi, S.C. Anand; New Age International (P) Limited, New Delhi, 2002.
2. R.M. Silverstein and F.X. Webster; Spectrometric Identification of Organic Compounds. Sixth Edition; John Wiley and Sons, Inc., Singapore.
3. William Kemp; Application of Spectroscopy; Third Edition; Palgrave Publisher Ltd., New York.
4. P.S. Kalsi; Spectroscopy of organic Compounds; Sixth Edition; New Age International (P) Ltd. Publishers, New Delhi.
5. The Elements of Physical Chemistry; P.W. Atkins; Oxford University Press, 1996.
6. Physical Chemistry; Seventh Edition; R.A. Alberty; Wiley Eastern Ltd., Singapore, 1987.
7. Physical Chemistry Through Problems S.K. Dogra and S.Dogra; Wiley Eastern Ltd, New Delhi, 2001.
8. Physical Chemistry, Suresh Ameta, RakshitAmeta, Hemleta; Himanshu Publications, New Delhi, 2020
9. Engel, Physical Chemistry, Pearson Publications.
10. Mary Anne White, Physical Properties of Materials, Taylor & Francis second edition.
11. D N Bajpai, Advanced Physical Chemistry, S. Chand Publishing


**Practical-II**

**Credit of the Course**: **2**

**Syllabus:**

1. Identification of organic compounds through functional group analysis and preparation of their derivatives:
    a) Hydrocarbons: Benzene, Toluene, Naphthalene, Anthracene
    b) Carboxylic acid: Oxalic, Tartaric, Citric, Benzoic, Succinic, Cinnamic, Salicylic, Phthalic acids
    c) Alcohols: Methyl, Ethyl, Propyl, Isopropyl, *n*-butyl, isobutyl, tertbutyl alcohols
    d) Phenols: Phenol, Resorcinol, Hydroquinone, *p*-Cresol, α-Naphthol, β-Naphthol
    e) Carbohydrates: Glucose, Fructose, Cane sugar, Starch
    f) Aldehydes: Formaldehyde, Acetaldehyde, Benzaldehyde
    g) Ketones: Acetone, Ethyl methyl ketone, Acetophenone, Benzophenone
    h) Esters: Methyl acetate, Ethyl acetate

i) Halogen Containing Compounds: Chloroform, Chloral hydrate, Iodoform, Chlorobenzene, *p*-Dichlorobenzene, *p*-Dibromobenzene
j) Nitro compounds: Nitrobenzene, *p*-Nitrotoluene, *m*-Dinitrobenzene
k) Amino compounds: Aniline, *o*-, *m*- and *p*-Toluidine, α-Naphthylamine and β-Naphthylamine
l) Anilides: Acetanilide and Benzanilide
m) Amides: Acetamide, Benzamide, Urea
n) Thioamide: Thiourea

2. Chemical Kinetics
   a) To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
   b) To study the effect of acid strength on the hydrolysis of an ester.
   c) To compare the strength of HCI and $H_2SO_4$ by studying the kinetics of hydrolysis of ethyl acetate.
   d) To study kinetically the reaction rate of decomposition of iodide by $H_2O_2$

3. Viscosity
   a) To determine the percentage composition of a given mixture (non interacting systems) by viscosity method.
   b) To determine the percentage composition of a given binary mixture by viscosity method (acetone & ethyl methyl ketone)
4. Surface Tension
   a) To determine the surface tension of amyl alcohol in water at different concentrations and calculate the excess of these solutions.
   b) To determine the percentage composition of a given surface tension binary mixture by surface tension method (acetone &ethyl methyl ketone).
5. Viva-Voce
6. Evaluation of record book of experiments performed in semester.

**TUTORIAL**

**Credit: 01**

Seminars /assignments / presentations /industry visits/mini projects /data analysis in chemistry practical

**DCMA-201: Calculus-II**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |

| | | | |
|---|---|---|---|
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Calculus-II**

**Course Learning Outcomes:** After completion of this course the student will be able to:

- Understand the meaning and applications of Gradient, Divergence and Curl.
- Compute Double and Triple Integrals.
- Compute area of surfaces of revolution and the volume of solids by integrating over cross-sectional areas.

**UNIT-I**

Algebra of vectors and scalars: Scalar product of two vectors, vector product of two vectors, scalar triple product of three vectors, vector triple product. Vector differentiation: Scalar and vector functions, limit and continuity of vector and scalar functions, derivative of a vector function, geometrical interpretation of the derivative of a vector function, derivative of the sum, scalar product and vector product of two vector functions, partial derivative of a vector function.

**UNIT-II**

Gradient, Divergence and Curl: Scalar and vector fields, vector differential operations, vector identities, geometrical significance of the gradient, Directional derivative of a scalar function. Vector Integration: Line, Surface and Volume integrals, Gauss's divergence theorem, Stokes' theorem and Green's theorem in the plane.

**UNIT-III**

Beta and Gamma function, Reduction formulae, Double and Triple integrals, Dirichlet's integral and its value, change of order of integration double integrals, change of variables in multiple integration.

**UNIT-IV**

Area of plane curves (Quadrature): Area bounded by curves, area and mass by double integration, Ractification, Volumes and surfaces of solids formed by the revolution.

**Recommended Readings:**

- Calculus Vol. 1 and 2, T.M. Apostol, 2007, Wiley.
- Vector Calculus by Michael Corral, 2022.
- Vector Calculus: R. Kumar, Vardhman Publications, 2018.
- A Text Book of Vector Calculus: Shanti Narayan, 1956.

**DCMA-202: Real Analysis-II**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.

- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| Distribution Marks for the course | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Essay/ Presentation / Report/Project/ Seminar/ Quiz etc. (at the end of 15th Week).

**Real Analysis-II**

**Course Learning Outcomes:** After completion of this course the student will be able to:

- Understand Mean value theorems and their applications.
- Define Riemann integration and Fundamental Theorems of Calculus.
- Apply the Weirestrass M-Test, Abel's and Dirichlets' test for uniform convergence.

**UNIT-I**

Basic properties of the limits, Continuous functions and classification of discontinuities, properties of continuous functions, Boundedness of a continuous function on a closed interval [a,b], existence of extreme values of a continuous function on [a,b], Uniform continuity of functions.

**UNIT-II**

Differentiability, chain rule of differentiability, Mean value theorems and their geometrical interpretations, Darboux's intermediate value theorem for derivatives, Taylor's theorem with various forms of remainders.

**UNIT-III**

Definition of Riemann integration, Inequalities for upper and lower Darboux sums, Necessary and sufficient conditions for the Riemann integrability, Definition of Riemann integration by Riemann sum and equivalence of the two definitions, Riemann integrability of monotone functions and continuous functions, Properties of Riemann integrable functions, Definitions of piecewise continuous and piecewise monotone functions and their Riemann integrability, intermediate value theorem for integrals, Fundamental theorems (I and II) of calculus, and the integration by parts.

**UNIT-IV**

Pointwise and uniform convergence of series of function, Weirestrass M-Test, Abel's and Dirichlets' test for uniform convergence. Improper integrals and their convergence, Comparison tests, Abel's and Dirichlet's tests.

**Recommended Readings:**


- Mathematical Analysis: S.C. Malik, New Age International, New Delhi, 2004.
- Real Analysis: T.M. Apostol, Narosa Publishing House, New Delhi 1985.
- Real Analysis: H.L. Royden, Macmillan, 4th edition 1993.
- Principles of Mathematical Analysis: W. Rudin, McGraw Hill, 3rd edition 1976.


**DCMA-203: Abstract Algebra-I**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.

- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Abstract Algebra-I**

**Course Learning Outcomes:** After completion of this course the student will be able to:
i) Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups, etc;
ii) Link the fundamental concepts of Groups and symmetrical figures;
iii) Analyze the subgroups of cyclic groups;
iv) Explain the significance of the notion of cosets, normal subgroups, and factor groups.

**UNIT-I**

Groups and its Elementary Properties: Symmetries of a square, The Dihedral groups, Definition and examples of groups, Elementary properties of groups, Subgroups and Cyclic Groups: Subgroups and examples of subgroups, Centralizer, Normalizer, Center of a group, Product of two subgroups; Properties of cyclic groups, Classification of subgroups of cyclic groups.

**UNIT-II**

Permutation Groups and Lagrange's Theorem: Cycle notation for permutations, Properties of permutations, Even and odd permutations, alternating groups; Properties of cosets, Lagrange's theorem and consequences including Fermat's Little theorem;

**UNIT-III**

Normal subgroups, factor groups: Applications of Factor Groups, Internal Direct Products, Properties of External Direct Products, Fundamental Theorem of Finite Abelian Groups.

**UNIT-IV**

Group Homomorphisms: Group homomorphisms, Properties of homomorphisms, Group isomorphisms, Cayley's theorem, Properties of isomorphisms, First, Second and Third isomorphism theorems for groups.

**Recommended Readings:**


1. Fraleigh, John B. A first course in Abstract Algebra
2. Gallian, Joseph. A. (2013). Contemporary Abstract Algebra (8th ed.). Cengage Learning India Private Limited, Delhi. Fourth impression, 2015.
3. Rotman, Joseph J. (1995). An Introduction to The Theory of Groups (4th ed.). Springer Verlag, New York.

**DCPY-201: Optics**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** Student teachers will be able to:

1. Explain the concepts of aberration in lenses.
2. Discuss the phenomena of interference, diffraction and polarisation.
3. Apply the concepts of interference, diffraction and polarisation in different experiments of light.
4. Distinguish between interference and diffraction.
5. Classify interference and diffraction phenomena.
6. Experiment on diffraction due to single, double and N slits.
7. Explain the applications of polarization phenomenon in daily life.

**UNIT-I**

Aberration in images: Chromatic aberrations, achromatic combination of lenses in contact and separated lenses, Monochromatic Aberration and corrections, aplanatic points of a spherically refracting surface and sphere, oil immersion objectives, meniscus lens.
Optical instruments: Entrance and exit pupils, Need for a multiple lens, eyepiece, common types of eyepieces

**UNIT-II**

Interference of a light: Division of wavefront and division of amplitude, The principle of superposition, two-slit interference, Fresnel biprism, thin film interference, Newton‘s rings, application of interference in determination of wavelength and precision measurements.
Haidinger fringes: fringes of equal inclination, Michelson interferometer, its application for precision determination of wavelength, wavelength difference and the width of spectral lines, Intensity distribution in multiple beam interference, FabryPerot interferometer.

**UNIT-III**

Fresnel diffraction: Fresnel half-period zones, Types of zone plates, Circular aperture, Circular disc, Diffraction at a straight edge, Construction and working principle of Zone plate and its application as a lens. Fraunhofer diffraction: Phasor diagram, Diffraction at a single slit, double slits & N parallel slits and their intensity distribution, plane diffraction grating, reflection grating and blazed grating, Concave grating and different mountings, diffraction at a circular aperture, Rayleigh criterion of Resolution, Resolving power of Telescope, Microscope, Grating and Prism.

**UNIT-IV**

Polarization and Optical Rotation: Meaning and representation of Polarized light, Types of polarized light, Production of Polarized light, Brewster law, Malus law, double refraction, Phase retardation plates, Analysis of Polarized light as plane polarized, circularly polarized and Elliptically polarized light, Rotation of plane of polarization, Specific rotation and its experimental determination, Polarimeter (Laurent and Biquartz).

**Suggested Readings:**

- Physical Optics: B. K. Mathur and T. P. Pandya.
- A textbook of Optics: N. Subrahmanyam, Brijlal and M. N. Avadhanulu
- Geometrical and Physical Optics: Longhurst.
- Introduction to Modern Optics: G. R. Fowels.
- Optics: P. K. Srivastav

**DCPY-202: Oscillations, Waves and Acoustics**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** Student teachers will be able to:

- Discuss the concept of free oscillations of simple systems.
- Apply the concept of potential well to solve the problems of oscillatory systems.

- Distinguish between damped and forced oscillation.
- Explain the concept of wave equation in different media.
- Discuss between reflection, refraction, and diffraction of sound.

**UNIT-I**

Oscillations: Potential well and periodic oscillations, cases of harmonic oscillations, different equations and its solutions, Kinetic and potential energy, Simple Harmonic oscillations in – Spring and mass system, Simple and compound pendulum, Torsional pendulum, Bifilar oscillations, Helmholtz resonator, LC circuits, Vibration of a magnet, Oscillation of two masses connected by a spring, Superposition of two simple harmonic motions of same frequency along the same line, Interference, Superposition of two mutually perpendicular simple harmonic vibrations of same frequency, Lissajou‘s figures, Cases of different frequency.

**UNIT-II**

Damped and forced oscillations: Damped oscillations; critical damping, quality factor, power dissipation. Forced oscillator, Transient and steady state oscillations, resonance, energy absorption, low and high frequency responses.
Coupled Oscillations: Two coupled oscillators, normal modes, energy transfer between modes, N-coupled oscillators, coupled pendulum.

**UNIT-III**

Waves in Media: Classical wave equation in one dimension, wave velocity, Speed of transverse waves on a uniform string, speed of Longitudinal waves in a fluid, energy density and energy transmission in waves, waves over liquid surfaces, gravity waves and ripples, Group velocity and Phase velocity, beats and combination tones, linear homogeneous equations and the superposition principle, nonlinear superposition and consequences.

**UNIT-IV**

Acoustics: Noise and Music, The human ear and its responses, limits of human audibility, intensity and loudness, bel and decibel, the musical scale, temperament and musical instruments, Production and detection of ultrasonic and infrasonic waves and applications, Transducers and their characteristics, Recording and reproduction of sounds, various systems, Measurements of frequency, waveform, intensity and velocity, The acoustics of halls, reverberation period, Sabine‘s formula.

**Suggested Readings:**

- Waves and Oscillations, Berkley Physics Course Vol. III
- Vibrations and waves, I.G. Main (Cambridge University Press)
- The Physics of Vibrations and Waves, H.J. Pain, McMillan (1975)
- Waves & Oscillations, Satya Prakash, Pragati Prakashan
- Oscillations,Waves and Acoustics (In Hindi) by Kakani,Bhandari&Kalra

**DCPY-203: Relativity**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.

- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| Distribution Marks for the course | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc. (at the end of 15th Week).

**Course Learning Outcome:** Student teachers will be able to:

- Discuss the Lorentz transformations.
- Discuss Doppler Effect in relativity.
- Explain the concepts of length contraction and time dilation.
- Explain the concepts of mass energy equivalence.
- Apply the concepts of Electromagnetic field tensor and its invariance in solving the problems.

**UNIT-I**

The Lorentz transformations: Newtonian relativity, instances of their failure, electromagnetism, aberration of light, Michelson-Morley experiment; Einstein's basic postulates of special theory of relativity, Lorentz transformations, length contraction, simultaneity, synchronization and time dilation, Einstein's velocity addition rule.

**UNIT-II**

Relativistic dynamics: Variation of mass with velocity, mass energy equivalence, relativistic formulae for momentum and energy, The structure of space-time: Four vectors, invariance of an interval, time-like, space-like and light-like intervals, Minkowski space.

**UNIT-III**

Relativistic electrodynamics: Electric field of a point charge in uniform motion, transverse components, magnetism as a relativistic phenomenon, transformation of E and B fields. Gravitational red-shift, Doppler effect in relativity, Four dimensional space-time and concept offour vector, Four-vector potential, four velocity, four frequency.

**UNIT-IV**

General Relativity: Principle of Equivalence, Cosmology, Friedman-Robertson-Walker Metric, Schwarzchild Metric, Gravitational Red Shift, Particle and Light Trajectories, Gravitational Lensing.

**TUTORIAL**

**Credit: 01**

Seminars /assignments / presentations /research lab visits/mini projects /data analysis related to special and general Relativity

**Suggested Readings:**


- Robert Resnick, Introduction to special relativity (Wiley India Pvt. Ltd., 2005).
- A.P. French, Special Relativity
- Relativity The Special and General Theory, Albert Einstein, 2005
- D.J. Griffiths: Introduction to Electrodynamics, Prentice Hall of India, 1989.
- Reitz and Milford: Introduction to Electrodynamics, Addison-Wesley.

- R.P. Feynmann, R.B. Leighton and M. Sands: The Feynmann lectures in physics, Vol. II (B.I. Publications).
- B. Saraf et al.: Physics through experiments Vol. I – EMF, constant and varying, Vikas Publishing House.
- D.R. Corson and P. Lorrain: Introduction to Electromagnetic fields and waves, Freeman-Taraporevala, Bombay, 1970.
- E.C. Jordan and K.G. Balmain: Electromagnetic waves and radiating systems, 2 nd Ed., Prentice Hall of India, New Delhi, 1971.
- Eletrodynamics ,Electromagetic Waves and Relativity (In Hindi) Kalra,Kakani and Bhandari

**Practical:**

- To study the normal modes of oscillators of system of coupled oscillator and to study the effect of coupling mass on the frequency of normal modes
- To study the frequency response and phase relationship of A.C. in a R.C. series circuit.
- To study the effect of damping on motion of a simple pendulum and determine damping constant for simple pendulum as damped harmonic oscillation.
- Study of a compound pendulum.
- Determination of wavelength of light using diffraction grating.
- To find out the wavelength of a monochromatic source of light using Newton's rings and find the refractive index of liquid.
- Find out the wavelength of a given monochromatic (Sodium light) source using Michelson's interferometer and determination of $D_1$& $D_2$.
- Determination of wavelength using Biprism.
- Determine the specific rotation of sugar solution by Polarimeter.
- Determination of a small thickness by interference method.

**Suggested Readings:**

- Concept of Quantum Mechanics;Beiser (McGraw Hill)
- Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.
- A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11th Edn, 2011,Kitab Mahal
- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.

**DCZO-201: Cell and Molecular Biology**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |

| | | | |
|---|---|---|---|
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** After successfully completing the course, the students will be able to:

- Appreciate the structure and function of organelles in a cell
- know cellular transport and protein trafficking, extra nuclear inheritance, linkage & crossing over
- Chromatin structure and organization
- Develop an understanding of concepts, mechanisms and evolutionary significance and relevance of molecular biology in the current scenario, recombinant DNA technology
- Apply the new avenues of joining research in related areas such as therapeutic strategies or related opportunities in industry.

**UNIT-I**

a) Introduction to cell: Discovery and characteristics of Prokaryotic (Bacterial) and Eukaryotic (Animal and Plant cell), Cell theory, Virus and viroids.
b) Cell membrane: ultra-structure, chemical composition, models, unit membrane concept, fluidity.
c) Glycocalyx and function of cell membrane, Modification (specializations) of plasma membrane.
d) Cell wall: bacterial cell wall, plant cell wall.
e) Transport along cell membrane: passive transport (diffusion and osmosis) facilitated diffusion, active transport (primary and secondary).
f) Endocytosis, exocytosis, pinocytosis
Cytoskeleton – intermediate filaments, microfilaments and microtubules

**UNIT-II**

Ultra-structure, types, chemical composition, origin and functions of:
a) Mitochondria including electron transport chain and generation of ATP
b) ER and Golgi complex
c) Lysosome, Ribosome
d) Centriole
e) Cilia, Flagella
f) Nucleus: Occurrence, number, shape, size, structure (nuclear envelops, nuclear matrix and nucleolus)
g) Chromosomes: introduction, discovery, morphology, structure (chromatids, primary and secondary constriction, nucleolar organizer and telomeres), types, chemical composition and functions

**UNIT-III**

a) Nucleic Acids: Salient features of DNA and RNA Watson and Crick model of DNA
b) DNA Replication: DNA Replication in prokaryotes and eukaryotes, mechanism of DNA replication, Semi-conservative, bidirectional and semi-discontinuous replication, RNA priming, Replication of circular and linear ds-DNA, replication of telomeres.
c) Transcription: RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes and eukaryotes, synthesis of rRNA and mRNA, transcription factors

**UNIT-IV**

a) Translation: Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; Process of protein synthesis in prokaryotes: Ribosome structure and assembly in prokaryotes, fidelity of protein synthesis, aminoacyl tRNA synthetases and charging of tRNA; Proteins involved in initiation, elongation and termination of polypeptide chain; Inhibitors

b) Post Transcriptional Modifications and Processing of Eukaryotic RNA: Structure of globin mRNA; Split genes: concept of introns and exons, splicing mechanism, alternative splicing, exon shuffling, and RNA editing, Processing of tRNA
c) Gene Regulation: Transcription regulation in prokaryotes: Principles of transcriptional regulation with examples from Lac operon and Trp operon;
d) Transcription regulation in eukaryotes: Activators, repressors, enhancers, silencer elements; Gene silencing, Genetic imprinting
e) DNA Repair Mechanisms: Pyrimidine dimerization and mismatch repair
Regulatory RNAs: Ribo-switches, RNA interference, miRNA, siRNA

**Practical:**

- Microscope: Simple and compound microscope, working mechanism and maintenance
- Study of bacterial and eukaryotic cell.
- Slides of sub cellular components (Cell organelles)
- Erythrocyte plasma membrane permeability.
- Study of Karyotype and Idiogram of man.
- Study of Polytene chromosomes from Chironomous / Drosophila larvae
- Preparation of liquid culture medium (LB) and raise culture of E. coli
- Estimation of the growth kinetics of E. coli by turbidity method
- Preparation of solid culture medium (LB) and growth of E. coli by spreading and streaking
- Demonstration of antibiotic sensitivity/resistance of E. coli to antibiotic pressure and interpretation of results
- Quantitative estimation of salmon sperm/calf thymus DNA using colorimeter (Diphenylamine reagent) or spectrophotometer (A260 measurement)
- Quantitative estimation of RNA using Orcinol reaction
- Study and interpretation of electron micrographs/ photograph showing (a) DNA replication (b) Transcription (c) Split genes

**Suggested Readings:**


- A textbook of Cytology by R.C Dalela & S.R. Verma – ( Jaiprashnath& Co. Meerut)
- Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
- Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter: Molecular Biology of the Cell, IV Edition.
- Cell function by L. L Langley – (Affiliated East West Press, New Delhi)
- Cell and Development Biology by Sastry, Singh &Tomar- ( Rastogi Publications 2008)
- Cell and Molecular Biology by P.K Gupta – ( Rastogi Publications 2008)
- Cell Biology : A molecular approach by R.D Dyson- Allyn& Bacon, Boston)
- Cell Biology by C.B Power –(Himalaya publishing House, Bombay)
- Cell Biology by de Robertis et. al- (W.B Saunders , Philadelphia)
- Cell Biology by J.D. Burke – (Scientific Book Agency , Calcutta)
- Cell Biology by R.M. Dowben – (Harper & Row, New York)
- Cell Biology Gerald Karp, 7th ed, Wiley Pub 2014
- Cooper G. M. and Robert E. Hausman R. E. The Cell: A Molecular Approach, V Edition, ASM Press and Sinauer Associates.
- Cytology by C.D. Darlington
- De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- Karp, G. (2010) Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.
- Lewin B. (2008). Gene XI, Jones and Bartlett
- McLennan A., Bates A., Turner, P. and White M. (2015). Molecular Biology IV Edition. GS, Taylor and Francis Group, New York and London.

- Molecular Biology of the Cell, Alberts et al, *5th ed Garland Science 2008*.
- Molecular Cell Biology, H Lodish MP Scott et al 7th Ed, McMillan Pub 2013.

**DCZO-202: Genetics and Evolution**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** After successfully completing the course, the students will be able to:

- Know how DNA encodes genetic information and the function of mRNA and tRNA
- Apply the principles of Mendelian inheritance, cause and effect of alterations in chromosome number and structure.
- Acquire an in-depth knowledge on the diversity and relationships in animal world.
- Develop a holistic appreciation on the phylogeny and adaptations in animals.
- Enable the students to understand the evolution of universe and life.
- Appreciate the process and theories in evolutionary biology.
- Develop an interest in the debates and discussion taking place in the field of evolutionary biology.

**UNIT-I**

a) Mendalian principals of inheritance – monohybrid cross and dihybrid cross, back cross and test cross
b) Deviation of Mendalism – incomplete dominance, co-dominance and lethal genes; modification of 3:1 and 9:3:3:1 with examples problems
c) Gene interactions: epistasis, complementary, supplementary, duplicate genes with cumulative effects and collaborator genes
d) Sex determination – genetic (sex chromosome, genic balance and haplo-diploidy mechanism)
e) Sex linked inheritance – white eyes colour in Drosophila, colour blindness and haemophilia in man
f) Crossing over: Definition, mechanism, theories, factors affecting crossing over and significance
g) Extra chromosomal inheritance- inheritance of mitochondrial and chloroplast genes, maternal inheritance

**UNIT-II**

a) Human Genetics: Pedigree analysis (Autosomal Recessive Traits, Autosomal Dominant Traits , X-Linked Recessive Traits, X-Linked Dominant Traits)
b) Linkage: definition, difference between linkage and independent assortment, chromosomal theory of linkage, kinds, linkage groups and significance
c) Gene mapping methods- Linkage maps
d) Genetics of ABO system, Rh disease and inheritance, sickle haemoglobin and inheritance, Thalassemia
e) Hardy Weinberg Law- Concept and rate of change in gene frequency through mutation, genetic drift, migration and natural selection
f) Population genetics- Population as a unit of evolution, gene pool, gene frequency
g) Structural and numerical alterations in chromosomes- deletion, duplication, inversion, translocation, ploidy & their genetic implications
h) Genetic disorders- Patau, Edward's, Chriduchat syndrome
i) Human Genome Project, DNA finger printing

**UNIT-III**

Origin of Life &its Theories

a) Origin of life (Abiogenesis and biogenesis)
    a. Evidence in favour of evolution: from morphology, comparative anatomy, embryology and Paleontology.
b) Molecular basis of evolution
c) Theories of evolution:
d) Lamarckism, inheritance of acquired characters and Neo-Lamarckism.
e) Darwinism, theory of natural selection and Neo Darwinism.
f) Mutation theory of Hugo de Vries.
g) Weismann theory of germplasm
h) Recapitulation theory
i) Variation: Kinds, sources of variation, origin of new mutations.
j) Isolation: Definition, mechanism and role of isolation in evolution.
k) Adaptation: Introduction, kinds (structural, physiological and protective) of animal associations, divergent evolution, convergent evolution, evolutionary significances of adaption.

**UNIT-IV**

a) Origin of species: Concept of species/subspecies/sibling. Specie, Factors causing genetic divergence in the population of species, genetic drifts, Bottle Neck effect founder's effect.
b) Mimicry and protective coloration: Definition, kinds, condition necessary for mimicry, significance.
c) Zoogeographical distribution of animals, geological time scale, origin and evolution of amphibian, reptiles, birds and mammals.
d) Introduction, formation, kinds, determination of age of fossil and its significance.
e) Dinosaurs, fossil evidence & reasons for extinction of dinosaurs.
f) Evolution of man: Time of origin, compelling causes, ancestor of man, evolution from apes and evolutionary trends.

**Practical:**

- Study of Barr Bodies in human buccal epithelial cells.
- Identification of blood groups (ABO) and Rh factor in man.
- *Drosophila* culture and life cycle.
- Sexual Dimorphism in *Drosophila*, Identification of wild or mutant varieties.
- Study of salivary gland chromosomes of Drosophila
- Problems on pedigree analysis.
- Meiotic studies of testes of cockroach.
- Study of vestigial organs, models of dinosaurs, living fossils.
- Study of teeth and skulls of horse, elephant and man.
- Study of five animals for mimicry.
- Study of various types of beaks of local birds.

- Study of various types of feet of local birds.
- Evolution of Man (Chart / Model).
- Evolution of Horse (Chart / Model).
- Zoogeographical distribution of animals in India and World.

**Suggested Readings:**


- Molecular Biology of the Cell, Alberts et al, 5thed Garland Science 2008.
- Molecular Cell Biology, H Lodish MP Scott et al 7th Ed, McMillan Pub 2013.
- Essentials of Molecular Biology,2nded, David Freifileder, Panima Publishing New Delhi 1996
- Biochemistry and Molecular Biology, K Wilson & J Walker, 7th Cambridge 2010.
- A textbook of Cytology by R.C Dalela & S.R. Verma – (Jaiprashnath & Co. Meerut)
- Cell and Molecular Biology by de Robertis EDP & de Robertis EMI Jr. (1996). Holt WB Saunders International
- Genetics- P.S. Verma & V.K. Agarwal , S. Chand & Co. Delhi
- Principles of Genetics Gardner , Ed 7th Wiley Eastern Pvt. Ltd. 2013
- Genetic – Winchester , Oxford IBH Publications
- Genetic – Stickberger, Macmillian Publications.
- Evolutionary Biology by B.S. Tomar & S.P. Singh – ( Rastogi Publications, 2008)
- The origin of life by K. John – (Reinhold Publishing Corpn)
- The evolution of Man by G.W. Lasker – ( Holt, Rinehart & Winston)
- Organic Evolution by R.S. Lull – ( Mac Millan)
- Organic evolution – V.B. Rastogi
- Animal Taxonomy and Evolution, VS Pawar Hindi Edition, College book centre, Chaura Rasta, Jaipur
- Mammalian Endrocrinology and Animal Behavior, VS Pawar, Hindi Edition, College book centre, Chaura Rasta Jaipur


**DCZO-203: Biochemistry**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)

C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** After successfully completing the course, the students will be able to:

- Know about the importance and scope of biochemistry.
- Recognize the structure and biological significance of carbohydrates, amino acids, proteins, lipids and nucleic acids.
- Know the concept of enzyme, its mechanism of action and regulation.
- Learn the preparation of models of peptides and nucleotides and biochemical tests for amino acids, carbohydrates, proteins and nucleic acids.

**UNIT-I**

a) Carbohydrates: Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates
b) Lipids: Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids, Steroids
c) Proteins: Amino acids: Structure, Classification and General properties of α-amino acids; Physiological importance of essential and non-essential α-amino acids Proteins: Bonds stabilizing protein structure; Levels of organization in proteins; Denaturation; Introduction to simple and conjugate proteins Immunoglobulins: Basic Structure, Classes and Function, Antigenic Determinants

**UNIT-II**

a) Nucleic Acids: Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids Cot Curves: Base pairing, Denaturation and Renaturation of DNA Types of DNA and RNA, Complementarity of DNA, Hpyo-Hyperchromaticity of DNA
b) Enzymes: Nomenclature and classification; Cofactors; Specificity of enzyme action
c) Isozymes; Mechanism of enzyme action; Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Derivation of Michaelis-Menten equation, Concept of Km and Vmax, Lineweaver-Burk plot; Multi-substrate reactions; Enzyme inhibition; Allosteric enzymes and their kinetics; Regulation of enzyme action

**UNIT-III**

a) Overview of Metabolism: Catabolism vs Anabolism, Stages of catabolism, Compartmentalization of metabolic pathways, Shuttle systems and membrane transporters; ATP as "Energy Currency of cell"; coupled reactions; Use of reducing equivalents and cofactors; Intermediary metabolism and regulatory mechanisms.
b) Carbohydrate Metabolism: Sequence of reactions and regulation of glycolysis, Citric acid cycle, Phosphate pentose pathway, Gluconeogenesis, Glycogenolysis and Glycogenesis

**UNIT-IV**

a) Lipid Metabolism: β-oxidation and omega -oxidation of saturated fatty acids with even and odd number of carbon atoms; Biosynthesis of palmitic acid; Ketogenesis.
b) Protein Metabolism: Catabolism of amino acids: Transamination, Deamination, Urea cycle; Fate of C-skeleton of Glucogenic and Ketogenic amino acids
c) Oxidative Phosphorylation: Redox systems; Review of mitochondrial respiratory chain, Inhibitors and un-couplers of Electron Transport System

**TUTORIAL**

**Credit: 01**

Seminars /assignments / presentations /industry visits/mini projects /visit to pathological laboratory/biochemistry laboratory and data analysis.

**Practical:**

- Qualitative tests of functional groups in carbohydrates, proteins and lipids.
- Paper chromatography of amino acids.

- Action of salivary amylase under optimum conditions.
- Effect of pH, temperature and inhibitors on the action of salivary amylase.
- Demonstration of proteins separation by SDS-PAGE.
- Estimation of total protein in given solutions by Lowry's method.
- Detection of SGOT and SGPT or GST and GSH in serum/ tissue
- To study the enzymatic activity of Trypsin and Lipase.
- Study of biological oxidation (SDH) [goat liver]
- To perform the Acid and Alkaline phosphatase assay from serum/ tissue.
- Dry Lab: To trace the labelled C atoms of Acetyl-CoA till they evolve as $CO_2$ in the TCA cycle

**Suggested Readings:**


- Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York.
- Cox, M.M and Nelson, D.L. (2008). Lehninger Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York.
- Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K.
- Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw- Hill Companies Inc.
- Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2008). Molecular Biology of the Gene, VI Edition, Cold Spring Harbor Lab. Press, Pearson Pub.


**INDC-201 A: Biodiversity and Conservation**

| | |
|---|---|
| Credits: 1L+1T+0P | Marks 50 |
| Contact hours per week: 5 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –

1. To make students understand ecology and basic ecological concepts.
2. To study interrelation between the living world and environment.
3. To make aware about environmental issues.
4. To understand plant part used of economic plants.
5. To interpret the application of ethnobotany

**UNIT: I**

Plant diversity and its scope- Genetic diversity, Species diversity, Plant diversity at the ecosystem level, Agrobiodiversity and cultivated plant taxa, wild taxa. Values and uses of Biodiversity: Ethical and aesthetic values, Precautionary principle, Methodologies for valuation, Uses of plants, Uses of microbes.

**UNIT: II**

Loss of Biodiversity: Loss of genetic diversity, Loss of species diversity, Loss of ecosystem diversity, Loss of agrobiodiversity, Projected scenario for biodiversity loss, Management of Plant Biodiversity: Organizations associated with biodiversity management-Methodology for execution-IUCN, UNEP, UNESCO, WWF, NBPGR; Biodiversity legislation and conservations, Biodiversity information management and communication.
Conservation of Biodiversity: Conservation of genetic diversity, species diversity and ecosystem diversity, In situ and ex situ conservation, Social approaches to conservation, Biodiversity awareness programmes, Sustainable development.

**UNIT: III**

Role of plants in relation to Human Welfare; a) Importance of forestry their utilization and commercial aspects b) Avenue trees, c) Ornamental plants of India. d) Alcoholic beverages through ages. Fruits and nuts: Important fruit crops their commercial importance. Wood and its uses.

**Suggested readings:**


- Koromondy, E.J.1996. Concepts of Ecology. 4th Edition Prentice-Hall of India Pvt. Ltd., New Delhi.
- Misra, K.C. 1988. Manuals of Plant Ecology. (3rd Edition) Oxford and IBH Publishing Co., New Delhi.
- Odum, E.P. 1983. Basic Ecology. 5th Edition Thomson Business International Waldis Pvt. Ltd., Baricahd.
- Odum, E.P. 2008. Ecology. Oxford and IBH Publisher.
- Sharma, P.D. 2010. Ecology and Environment, (8th Edition) Rastogi Publications, Meerut.
- Singh, J.S., Singh, S.P. and Gupta, S. 2006. Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi.


**TUTORIAL**

**Course Content:**

- Study of adaptive anatomical and morphological features of Hydrophytes, Epiphytes and Xerophytes using plant material.
- Study of soil pH, soil moisture in relation to depth, bulk density, porosity and water holding capacity of different soil samples.
- Determination of requisite size and number of quadrat for the study of plant community
- Study of structure of plant community by determining frequency, density and abundance of quadrat method.
- Study and Submission of economically important plants and plant products (cereals, pulses, spices, fibers, condiments, fat and oils, tea, coffee, wood, dyes, tobacco).
- Study and collection of plants available in RIE Ajmer campus
- Study of plants available in Navgrah vatika, theme park of college campus

**INDC-201 B: Chemical Technology and Society**

| | |
|---|---|
| Credits: 1L+1T+0P | Marks 50 |
| Contact hours per week: 5 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**

1. Analyze the ethical and environmental implications of chemical technologies, demonstrating an understanding of their impact on society.
2. Explain the fundamental principles of chemical processes and their applications in various industries, emphasizing safety and sustainability.
3. Evaluate the role of government regulations and policies in shaping chemical technology practices and their effects on public health.
4. Demonstrate proficiency in assessing and communicating scientific information to non-technical audiences, fostering greater public awareness and understanding of chemical issues.
5. Examine case studies of historical and contemporary chemical disasters, identifying root causes and proposing preventive measures.
6. Collaborate effectively with peers to develop solutions to real-world societal challenges related to chemical technologies, utilizing a multidisciplinary approach.

**UNIT-I**

**Chemical Techniques**

Basic principles of distillation, solvent extraction, solid-liquid leaching and liquid-liquid extraction, separation by absorption and adsorption, An introduction into the scope of different types of equipment needed in chemical technology, including reactors, distillation columns, extruders, pumps, mills, emulgators, Scaling up operations in chemical industry, Introduction to clean technology.

**UNIT-II**

**Chemistry and Society-I**

Exploration of societal and technological issues from a chemical perspective, Chemical and scientific literacy as a means to better understand topics like air and water (and the trace materials found in them that are referred to as pollutants).

**UNIT-III**

**Chemistry and Society-II**

Energy from natural sources (i.e. solar and renewable forms), from fossil fuels and from nuclear fission; materials like plastics and polymers and their natural analogues, proteins and nucleic acids, and molecular reactivity and inter conversions from simple examples like combustion to complex instances like genetic engineering and the manufacture of drugs.

**Suggested Readings:**

- John W. Hill, Terry W. McCreary & Doris K. Kolb, Chemistry for changing times 13th Ed

**INDC-201 C: Mathematical Modelling**

| | |
|---|---|
| Credits: 1L+1T+0P | Marks 50 |
| Contact hours per week: 5 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning outcomes:** Apropos conclusion of the course will empower the student to:

i. Learn the development, analysis and interpretation of bio mathematical models.
ii. Reinforce the skills in mathematical modelling.

**UNIT-I**

Introduction to Modelling, definition of system, classification of systems, classifications and limitations of mathematical models, methodology of model building, modelling through ordinary differential equations.

**UNIT-II**

Linear growth and decay models, non-linear growth and decay models, compartment models, checking model validity, verification of models, stability analysis, basic model relevant to population dynamics, Epidemics modelling.

**UNIT-III**

Ecology, environment biology through ordinary differential equations, partial differential equations, baisc theory of linear difference equations with constant coefficients.

**References:**


1. Murthy D.N.P, Page N.W. and Rodin E.Y., 1990, Mathematical Modelling; A Tool for Problem Solving in Engineering, Physics, Biological and Social Sciences, Pergamon Press
2. Kapur J.N., 2008, Mathematical Modelling, New Age Int. Pub.
3. Law A.M. and Kelton W.D., 1991, Simulation Modeling and Analysis, McGraw Hill.
4. Meerscheart M.M. 2007, Mathematical Modeling, Academic Press


## INDC-201 D: Nano Science

| | |
|---|---|
| Credits: 1L+1T+0P | Marks 50 |
| Contact hours per week: 5 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes:**

The student teachers will be able to:

- Discuss the size effects in nano science.
- Appraise the different synthesis methods of nanomaterials.
- Distinguish between SEM and TEM.
- Discuss the characterization techniques of nanomaterials.
- Explain the applications of nanomaterials in daily life.

### UNIT-I

Overview: Size effects and crystals, nanoscopic scale and quantum confinement, one dimensional, two dimensional and three dimensional nanostructured materials, Quantum Dots, Types of nanostructure and properties of nanomaterials: Shell structures, metal oxides, semiconductors, composites, mechanical, physical, chemical properties, carbon age, new form of carbon (CNT to Graphene), influence of nano over micro/macro, effects of nano scale dimensions on various properties–structural, thermal, chemical, magnetic, optical and electronic properties, effect of nano scale dimensions on mechanical properties - vibration, bending, fracture, emergence and challengs ofnanoscience and nanotechnology.

**UNIT-II**

Synthesis of Nano materials:Top-down and bottom-up approaches, Mechanical alloying and Ball milling, Plasma synthesis, Sol-Gel Synthesis, Inert gas Condensation, Electro deposition and other techniques, chemical vapor deposition, physical vapor deposition, Laser ablation, pulsed laser deposition.

Characterization tools: X-ray powder diffraction, Single crystal diffraction techniques, Thermogravimetry, Differential Thermal Analysis and Differential Scanning Calorimetry, Electron Energy Loss Spectroscopy, High Resolution Imaging Techniques- Scanning Electron Microscopy and Tunneling Electron Microscopy, Atomic Force Microscopy, Raman spectroscopy

**UNIT-III**

Applications: Functional materials, Biomedical applications, Molecular Electronics and Nanoelectronics, nano coating, nanomaterials for renewable energy, Nanobots, molecular electronics and nanoelectronics, environmental related application, membrane based application, polymer based application

**Practical**

1. Synthesis of Au/Ag nanoparticles using co-precipitation method,
2. Synthesis of CdS nanoparticle using hydrothermal process.
3. Synthesis of ZnO nanoparticles using sputtering process.
4. Synthesis of TiO2 nanoparticles using sol-gel process.
5. Synthesis of Fe2O3nanofibres using electrospinning
6. Preparation of WO3 nanostructures using microwave synthesis.
7. To optimize the concentration of nanoparticles dispersed solution using UV-vis spectroscopy.
8. Fabrication of porous alumina or anodized alumina template.
9. To find the optical band gap of the given semiconducting materials by measuring UV Visible transmission spectrum.
10. To find the average grain/crystallite size, unit cell parameters, microstrain by recording the X-ray diffraction pattern of the given sample.
11. Isolation of chromosomal DNA from microbes
12. Fractionation and Size Determination of nucleic acids and proteins – (i) Agarose Gel Electrophoresis and (ii) SDS – PAGE Electrophoresis
13. Estimation of Protein – Bardford Method
14. Separation Techniques: Chromatography (i) TLC and (ii) Column

**Suggested Readings:**


- Graphene synthesis, properties and Phenomena, C N R Rao and A K Sood, (Wiley VCH, 2010).
- Nanotechnology and Nanoelectronics, W R Fahrner,(Springer (India) Private Ltd., 2011).
- Fundamentals of Microfabrication, M Madou , (CRC Press, New York, 1997).
- Nano Technology, N Taniguchi, (Oxford University Press, New York, 2004).
- Emerging Nanotechnologies for Manufacturing, W Ahmed and M J Jackson, (Elsevier Inc, 2014).


**INDC-201 E: Wetland Conservation**

| | |
|---|---|
| Credits: 1L+1T+0P | Marks 50 |
| Contact hours per week: 2 | C1+C2=15 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.

- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Objectives:**

- To understand wetlands, their functions and services
- To understand the seriousness of threats to wetland from global to local level
- To develop ability to assess physico-chemical and biological conditions of a wetland
- To develop an understanding of wetland conservation and management
- to identify efforts by various stakeholders for wetland conservation to be able to prepare a management plan for wetland conservation

**Course Learning Outcome:** After successfully completing the course, the students will be able to:

- Understand the characteristics of wetlands, factors affecting the wetland health
- Understand the ecological and economical importance of wetlands.
- Understand the sustainable development and wetland conservation practices

**UNIT-I**

a) Definition, classification, Distribution and typology of wetlands
b) Wetland habitat and Ecosystem Services of wetland
c) Nutrient cycling, Productivity, trophic states
d) Physico-chemical characteristics of water and sediment
e) Biodiversity in wetlands: microbial, planktonic, floral and faunal.
f) Assessment of key Physico-chemical properties of water and sediment
g) Enumeration of phyto and zooplanktons, Chlorophyll estimation

**UNIT-II**

a) Major threats to wetlands, Natural and human impact, land-use and land-cover (LULC) change conservation issues of major wetlands of the world.
b) Ramsar Convention, Montreux Record
c) Ramsar Wetland sites in India
d) Wetlands of Rajasthan with special reference to Sambhar Lake, Keoladeo Ghana NP.

**UNIT-III**

a) Wetland Policy in India, Wetlands (Conservation and Management) Rules, 2017, institutional arrangement for wetland conservation and management
b) Assignment on identification of effects of LULC change on a wetland
c) A case study on wetland conservation in Rajasthan
d) Wetland Management plan, Assessment tools for baseline information collection, Approaches to assessment of aquatic biodiversity
e) Management of migratory water fowl, fisheries and vertebrates
f) Control of pollution and siltation, Management of aquatic weeds
g) Community participation in wetland conservation in India
a) Monitoring of wetlands, wetland Restoration, Lake front development, in-situ cleaning

b) Field visit to a wetland in Rajasthan, Presentation on the assignment and submission of the report

**Tutorial:**

- Assessment of Physico-chemical characteristics of water and sediment of nearby wetlands
- Assessment and characterization of Biodiversity in wetlands: microbial, planktonic, floral and faunal.
- Assignment on identification of effects of LULC change on a wetland
- A case study on wetland conservation in Rajasthan

**Suggested Readings:**


- Dodds. Walter K. (2002). Freshwater Ecology. Concepts and Environmental Applications. Elseiver Science. Academic Press. California.
- Gopal B. (1995). Handbook of Wetland Management, World Wide Fund for Nature India. New Delhi
- Gopal B. (2013). Environmental Flows. An introduction for water resource managers. National Institute of Ecology. New Delhi
- Wetzel, Robert G (2010). Limnological analysis. Springer Science. New York. USA
- Wetzel Robert G. (2001) Lake and river ecosystems. Elseiver. Academic Press. USA.
- An integrated Wetland assessment toolkit.
- IUCN.
- Ramsar Convention Handbooks
- Handbooks on Wetland Management by Convention on Biological Diversity.
- Standard methods for examination of water and waste water. (1998). 20th edition, American Public Health association (AHPA), American Water Works Association.
- Fraser, L.H. and P.A. Keddy (Eds). The World's largest wetlands: Ecology and Conservation. Cambridge University Press, UK
- Kar, Devashish. (2013). Wetlands and lakes of the world. Springer. New Delhi.
- Krishnamurthy, J., Sharachchandra Lele and R. Jayakumar. (2006). Hydrology and watershed services in the Western Ghats of India, Tata McGraw – Hill Publishing Company Limited. New Delhi.


**AEVA-201: Language-II (Other than Language-I)**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc. (at the end of 15th Week).

**About the Course**

The course aims to prepare the students to teach language at the school level. It focuses on training the students to the sounds systems of languages, word formation processes, sentence formation, semantic and pragmatic aspects of languages. The course intends to enable the learners to integrate all the four language skills using different genres. The major aim of this course is to empower the learners to contribute to the discourses on various issues and themes. The course also orients the students to the use of different technology and digital media for developing their own communicative skills as well as the school students they would teach in the future. The course helps improve basic communication skills such as listening, speaking, reading, and writing skills among L2 language learners. The course is designed to enhance knowledge of grammar of L2 and enable the students to formulate grammatically correct and contextually appropriate sentences and words and empower the students with summarizing skills, oral presentations skills effectively. The course also seeks to enhance students' critical thinking capacities and demonstrate effective communication skills and provide hands-on activities to student teachers to develop their linguistic skills through practical sessions

**Course Learning Outcomes**

After completing the course, student teachers will be able to:

- demonstrate reading, writing, listening, speaking, and thinking abilities in L2,
- recognize the link between language and mental skills and demonstrate their knowledge and skills effectively for all purposes,
- Build inter-personal relationships and enhance social skills.

**UNIT - I**

Language, Society, and learning

A. Bi-/Multilingualism and scholastic achievements; need to promote multilingualism; Language variation and social variation; languages, dialects and varieties, cultural transmission of language, language, and gender; language and identity; language and power; constitutional provisions and National Education Policy 2020.
B. Language acquisition and Language learning; language learning from mother tongues to other tongues; advantages of learning other languages; language and education; notion of first language, second language and others.

**UNIT - II**

Speech and Writing

A. Writing Systems: Speech and writing; arbitrariness in language; types of writing systems.
B. Classification sessions of speech sounds: vowels, consonants, and others; suprasegmental: stress, pitch, tone, intonation, and juncture; Acoustic phonetics.

**UNIT - III**

Understanding Grammar

A. Word and meaning; parts of speech, grammatical categories; word formation: affixation, compounding, reduplication, vocabulary building.
B. Sentence and its constituents: simple, complex, and compound sentences; Semantics and pragmatics: lexical meaning- synonymy, antonymy, meronymy, grammatical meaning, speech acts.

**UNIT – IV**

Basic Communication Skills in L2

A. Pronunciation and listening comprehension skills.
B. Reading and reading comprehension skills.
C. Effective writing skills; effective presentation and speaking skills; summarizing and paraphrasing skills.

D. Critical Reading and Thinking Skills: Components of critical thinking and reading; high order cognitive development; critical thinking and problem solving; rational inquiry

**Suggestive Practicum**

1. Listen to a recorded speech and classify it based on sounds: vowels, consonants, and others; suprasegmental: stress, pitch, tone, intonation, and juncture; Acoustic phonetics.
2. Analyze sentences and their constituents as simple, complex, and compound sentences from written work.

**Suggestive Mode of Transaction**

Teaching this course will involve a mix of interactive lectures, tutorials, and practical involves such as discussion, role plays, projects, simulations, workshops and language-awareness activities. The teaching intends deeper approaches to learning involving in- class room discussion, developing the critical thinking/ problem solving abilities among the students and will also focus on situations where in our daily lives the one would be performing tasks that involve a natural integration of language skills. The students are expected to read assigned chapters/ articles before the session and the course requires active participation from the students.

**Suggestive Mode of Assessment**

The assessment of the learner will be primarily based on the assessment of both linguistic and communicative skills using a battery of tests and test types, group work and projects.

**Suggestive Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning content.

**AEVA-202: Understanding India (Indian Ethos and Knowledge Systems)**

| | |
|---|---|
| Credits: 1L+1T+0P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

At a time when the world finds itself deep in dynamism, led by technological innovations and environmental changes, there is a need for an inward-looking approach to building the young minds of a country. By looking inwards, one not only finds a sociological belongingness but also a spiritual and intellectual rooting in these changing times. The course provides an overview of India's heritage and knowledge traditions across key themes of economy, society, polity, law, environment, culture, ethics, science & technology, and philosophy. It places special emphasis on the application of these knowledge traditions, helping students to not only know and appreciate India's heritage and knowledge traditions but also to independently evaluate them through a multidisciplinary lens. This evaluation would produce valuable lessons for obtaining transferable and 21st-century skills. The course requires no pre-requisite knowledge or understanding. Spread over two years, the course will establish foundational knowledge and build upon it. It will allow students to have a basic understanding of the traditions of India and how it has evolved over the years. The course is designed to enable student teachers to outline and interpret the processes and events of the formation & evolution of knowledge of India through a multidisciplinary lens; to evaluate the diverse traditions of India to distinguish its achievements and limitations, and to develop and articulate an ethics-based education rooted in Indian thought to their students in the classroom context.

**Course Learning Outcomes**

After the completion of the course, students will be able to:

- recognize the vast corpus of knowledge traditions of India, while developing an appreciation for it,
- apply their acquired research and critical thinking skills in multidisciplinary themes,
- summarize and pass on their learnings to their students of different Indian traditions in an easily digestible manner.

**UNIT - I**

Introduction of Knowledge of India

a) Philosophy, Ethics & Values: Schools of Philosophy Vaishesika, Nyaya, Samkhya, Yoga, Purva Mimansa and Vedanta or Uttara Mimansa (theory and the major thinkers) – and Jain, Buddhist, and Charvak traditions.
b) Vedanta: philosophical systems (Advaita, Vishishtadvaita, Dvaita).
c) Ethics, morality, and social dilemma (including self-leadership) and their relevance in today's time.
d) How do Indians value spirituality? Spirituality and Social Responsibility; Importance of Spirituality in current times.
e) Using ethics in a technologically volatile world: leading an ethical and modern life.
f) Practical Vedanta for well-being (mindfulness, inter-connectedness, society-self relationship, etc.).

**UNIT - II**

Culture- Lifestyle

a) Food (regional cuisines, ayurvedic diet, food and festival, vegetarianism, Jainism in food, food and hospitality, and globalization).
b) Clothes (traditional Indian clothing, textile arts, religious costumes, clothing status, clothing, gender, globalization in clothing).
c) Sports (traditional Indian sports, martial arts, sports, and gender, sports & globalization).
d) The lifestyle of Yoga; adapting ancient lifestyle – A path towards longevity.

**UNIT - III**

Science & Technology

a) Arithmetic and logic.
b) Natural sciences: math, physics, metallurgy, and chemistry.
c) Astronomy: India's contributions to the world.
d) Indian notions of time and space.
e) Technology in the economy: agriculture, transportation, etc.

Linguistic Traditions

a) History of linguistics in India (conceptualizing ancient Indian linguistics, oral traditions, etc.).
b) Language as Culture: Evolution of Languages over the years & language as building blocks to different cultures and society

c) Language: Identity, culture, and History.

**Suggestive Practicum**

The modes of curriculum transaction will include Lectures, Tutorials, and Practicum.

- Practicum will include organization of day trips that help student teachers watch events relating to visual and performing art; activities that enable student teachers to identify and record through photos, videos, etc. the elements of ancient architecture still existing in the city around them; organization of Individual and group presentations based on themes such as Polity, Law and Economy etc., organization of a 'Knowledge of India' day in the institution to celebrate the culture (food, clothes, etc.) that they would have been explored in lectures and tutorials; interactions with family members, elders, neighbors, and other members of society about the evolution of local systems and economy etc.

**Suggestive Mode of Transaction**

- Lectures will include learner-driven participatory sessions, and Guest lecturers through experts and practitioners, such as fine arts and performing arts practitioners along with contemporary poets & writers of Indian literature.
- Tutorials will include Screening of documentaries and films followed by a discussion; Learner-driven discussions in the form of focus group discussions (FGDs), Socratic Discussions, etc.; Debate/discussion can be organized to explain India's Vaad tradition; discuss on how some of the ancient methods of teaching are relevant in today's time; discussions that help Identify ethical dilemmas in daily lives and understanding the importance of ancient ethics and values to resolve them.

**Suggestive Mode of Assessment**

The approaches to learning assessment will include, for example:

- Supporting the curiosity and interest of student teachers in the selected themes through a multi-modal approach, including regular assessments and actionable feedback that enable learners to outline and interpret the processes and events of the formation & evolution of knowledge of India through a multidisciplinary lens.
- Enabling the student teachers to demonstrate critical analysis and independent thinking of the processes and events in the formulation & evolution of different traditions that help student teachers evaluate the diverse traditions of India to distinguish its achievements and limitations.
- Use of first-hand or second-hand experiences that enable student teachers to develop and articulate an ethics-based education rooted in Indian thought to their students in the classroom context.

**Suggestive Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning

**AEVA-203: Teacher and Society**

| | |
|---|---|
| Credits: 1L+1T+0P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.

- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| Distribution Marks for the course | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc. (at the end of 15th Week).

**About the Course**

Teachers unarguably have the key role in nurturing young lives and shaping positive and inspired future generations. Emphasizing on the crucial role of teachers NEP 2020 states "teachers truly shape the future of our children - and, therefore, the future of our nation.". "The high respect for teachers and the high status of the teaching profession must be restored to inspire the best to enter the teaching profession. The motivation and empowerment of teachers is required to ensure the best possible future for our children and our nation." (NEP Para 5.1). The NEP in its introductory section states, "the teacher must be at the centre of the fundamental reforms in the education system" and highlights the need to "help re-establish teachers, at all levels, as the most respected and essential members of our society, because they truly shape our next generation of citizens". (NEP 2020, Introduction). The policy also stresses the need to "do everything to empower teachers and help them to do their job as effectively as possible." It is recognized that teachers are second to mothers in having the opportunity to work with children during the most impressionable years in their life and shape opinions, form ideas about personal and social goals and about society and life, contributing so much to the development of both individuals and society.

The focus of the course on 'Teacher & Society' is on developing an understanding among student teachers of the roles of teachers in the emerging Indian society, including the changing roles of teachers in the context of the global flows of people, culture and resources that are shaping society, and the application of technologies that are constantly redefining not only the educational landscape but also the human relationships and social norms which are continuously undergoing change which entails a recalibration of the teacher roles aligned to the current and future realities and preparing teachers for the volatile, uncertain, complex and ambiguous world. The course enables the students to understand the roles and obligations of teachers as an architect of the society based upon the cultural ethos, traditions, and diversity. The student teachers shall be equipped with the knowledge, capacities and value system that enables them to act as an agent for fostering national integration, a feeling of pride in the cultural heritage and achievements of India. This course also aims to ensure that student teachers understand their responsibility for producing a future generation that undertakes its responsibility as an awakened citizen who avoids wastage of national resources and takes up a proactive role for the emergence of India as a strong and disciplined nation.

In addition to these, the course also seeks to enable each of the student teachers to respond to the needs of students from diverse cultural, linguistic, social and economic backgrounds; to be sensitive to gender issues, promote tolerance and social cohesion, provide special attention to students with learning disabilities, learn and apply new pedagogies and technologies, keep pace with current educational developments and initiatives; and keep oneself professionally engaged to update/upgrade knowledge and practice. Student teachers will be encouraged to comprehend how societal structures, context and historical patterns shape teacher identities on one hand and how teacher identities, beliefs, values, convictions and commitment shape the ethics, culture, norms and values on the other; thus, impacting the larger societal thoughts and actions. The course also explores the relationship of the teacher with education development, community and society through different course units that talk of the teacher as a person and as a professional, the socio-cultural and technological contexts of the teacher and how they impact the teaching- learning process, the multiple roles, identities and expectations of a teacher. It invites the student teachers to be reflexive of one's thoughts, beliefs and actions and continuously take a gaze inside out so as to unbiasedly engage children in a reflective dialogue.

The course explores the agentic role of a teacher, how it gets influenced and how it influences the education system. It concludes with the re-calibrating of roles of teacher and teaching beyond the curricular boundaries as an architect of an inclusive, harmonious, and developing India.

**Course Learning Outcomes**

After completion of the course, student teachers will be able to:

- examine the relationship between teacher beliefs, values, character, life history, social and cultural context and teaching critically,
- explain the teacher roles and characteristics; the personal and professional self; the teacher as a communicator, the charismatic influencer, the reflective practitioner, competent, learner and much more and their significant role in nurturing the posterity.
- differentiate between the narrow curricular aims of education and the broader educational aims and their role in shaping self, school, and society,
- demonstrate an ability to develop positive classrooms through engaging in the ethic of care,
- demonstrate an ability to critically reflect on personal and collective practice so as to improve learning and teaching,
- conceptualize teacher agency, its individual, contextual, and structural dimensions and how it gets impacted and in turn shapes education.

**UNIT – I**

Understanding the Teacher: Exploring the Personal and Professional Teacher

a) Exploring the wider Personal and General Social Context of Teacher: Life History, Teacher Beliefs, Values and Aspirations, Diverse Identities, Social Contexts and Commitment to Learning and Education.
b) Exploring the Professional Teacher: Qualifications, Education in teaching, Attitude, Aptitude, Experience and Exposure.
c) The Charismatic Teacher, the Communicator Teacher, the Missionary Teacher, the Competent Practitioner, the Reflective Practitioner, the Learning Teacher.
d) Reflexive Practice: Nurturing the Professional Capital through collaborative and/or collective engagement with self, others, the social context.

**UNIT – II**

Understanding and Fostering Teacher Agency: Role in shaping Education Systems of Tomorrow

a) Teacher Agency: What is it and why does it matter?
b) Individual, Cultural and Structural Dimensions of Teacher Agency.
c) Teacher discourses, Philosophy, Relationships, Networks and Professional Development: Shaping teacher agency and Creative insubordination.
d) Challenges and Issues in fostering Teacher Agency: Performativity, Non-academic engagements, Systemic apathy, Policy and Practice gaps and others.
e) Role of Teacher in shaping the educational policy, practice, and reforms

**UNIT – III**

A. Nurturing the Teacher: A Dialogue beyond the curricular goals, for Life and Posterity
   - Teaching: One profession, many roles
   - Teaching Character: Nurturing Teachers for Human Flourishing.
   - Holistic Teacher Development: Nurturing the Panchakoshas.
   - Teacher Values, Beliefs, and current Philosophy of Teaching: A Reflective Dialogue.
   - Developing an Ethic of Care in Teacher Education: Nurturing Teachers towards pedagogy of care.

B. Teacher as an Architect of the New India: Shaping the Society of Tomorrow
   - Engaging in Critical Education: Dialogues on power relations associated with Gender, Ethnicity, Culture, Disability, Class, Poverty, the reproduction of disadvantage and realizing the true human potential.
   - Being a Critical Teacher: Raising debates around rapid technological advancement and impact on individual, family and social life; the growing isolation and impact on mental and social health and well-being, changing relationships between the ‘state’ and the ‘market’ and their impact on formal education; the conceptualization of teacher, teaching and teacher roles, ‘globalization’ and the reconstructed nationalism shaping the socio-political milieu and impact on social psyche, growing materialistic urge, sensory drives and the gradual deterioration of the individual and societal character.

**Suggestive Practicum**

1. Take up a case study of any one teacher education Institution.
2. Write a biography of any one of your favourite teachers/ Educationists.

**Suggestive Mode of Transaction**

Teacher and Society is a reformatory course that invites teachers to re-think teachers and teaching. It awakens and inspires teachers to realize broader educational aims through an action and reflection cycle. The approach therefore would include a blend of lectures, in-class seminars, thinking exercises, critical reflections, group-work, case-based approaches, and enquiry-based learning.

- Learners would also be exposed to case studies featuring teachers from a representative cross-section of Schools in India and critically analyse their exercise of agentic force in school improvement and the improvement of teaching practice.
- Situating themselves in the geo-political context, the learners will get to critically engage in some of the policy dialogues.
- Learners would reflect on their practice as pre-service interns, knowledge, skills, and understandings—and identify opportunities to apply course learnings to their school context.

**Suggestive Mode of Assessment**

Being a very thought-provoking course, the assessment would largely include critical thinking kind of assignments. The following are some exemplars.

1. Write your current teaching philosophy based on your beliefs and values.
2. Choose any one area of immediate societal concern like environmental degradation, increasing crime against women, cybercrimes, bullying or any other and draw an action plan that you as a teacher would undertake to mobilize self, school and society towards betterment.
3. Critical Reflections on popular debates around power relations associated with Gender, Ethnicity, Culture, Disability, Class, Poverty, and such others These are just prototypes and institutes may choose either of these or think of other innovative assignments that would inculcate in the future teachers a sense of belonging for society.

**Suggestive Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning content.

# SEMESTER

# III

**EDFE-301: Child Development & Educational Psychology**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

To enable student teachers to understand the interplay of three different processes namely biological processes, cognitive processes, and socio-emotional processes that influence development of a child. Biological, cognitive, and socio-emotional processes are intricately interwoven with each other. Each of these processes plays a role in the development of a child whose body and mind are interdependent.

The course seeks to provide an understanding of the developmental characteristics of a child:

- during infancy that ranges from birth to 24 months of age,
- during Early Childhood stage which begins around age 3 and usually extends up to years of age,
- Middle to Late Childhood stage which begins around 6-7 years to 10-11 years of age, and
- Adolescence stage which begins at approximately the age of 12 years, and which is a period of transition from childhood to early adulthood.

The course will introduce development across domains – physical development, cognitive development, language development, socio-emotional development, aesthetic development, moral development – during each of the above-mentioned developmental stages of a child.

Educational Psychology component of the course:

Informs student teachers about the various theories of learning and motivational states for learning and their implications for pedagogy. It includes the study of how people learn, pedagogical approaches that are required to improve student learning, teaching learning processes that enable learners to attain the defined learning outcomes, and individual differences in learning. It provides opportunities to student teachers to explore the behavioral, cognitive and constructivist approach to facilitating student learning, and the emotional and social factors that influence the learning process.

**Course Learning Outcomes**

After completion of this course, student teachers will be able to:

- describe the meaning, concept, characteristics, and factors affecting growth and development,

- use the knowledge of Indian concept of self,
- apply various problem solving and learning strategies in real classroom settings,
- identify the various approaches of the process of learning,
- explain group dynamics and apply strategies to facilitate group learning.

**UNIT - I**

Child Development

A. Meaning and significance of understanding the process of Child Development
   - Biological, cognitive, socio-emotional, and moral.

B. Developmental characteristics of a child during:

- Infancy stage
- Early Childhood stage
- Middle to Late Childhood stage
- Adolescence stage

C. The Indian concept of self: Mind (मनस्), Intellect (बुद्धि), Memory (द्धित्त), Panch-koshIya Vikas (पञ्चकोशीय द्धिकास ).

D. Educational Implications.

**UNIT - II**

Developmental Process

Development across domains:

- Physical Development
- Cognitive Development
- Language Development
- Socio-Emotional Development
- Aesthetic Development
- Moral Development

During each of the above-mentioned developmental stages of a child.

A. Factors affecting development.

B. Individual differences:

- Children with special needs including developmental disorders.
- Tools and Techniques for Identifying Learner with different abilities.

C. Teachers' role and strategies to address the needs of learners with different learning abilities.

**UNIT - III**

Process of Learning

A. Conceptual Clarity and significance.

B. Approaches:

- Behaviorist
- Cognitivist
- Constructivist
- Developmental
- Information processing Model of learning
- Shri Aurobindo's Integral approach

C. Problem Solving and Learning Strategies: Inquiry and problem-based learning, Steps and Strategies in problem solving, Factors hindering problem solving.

D. How to Learn: Significance and Strategies

**UNIT – IV**

Motivation and Classroom Management

A. Motivation

- Conceptual clarity, nature, and significance

- Intrinsic and Extrinsic Motivation
- Strategies for Motivation

B. Classroom management

- Creating a positive learning environment
- Planning space for learning
- Managing behavioral problems

C. Group dynamics:

- Classroom as a social group
- Characteristics of group
- Understanding group interaction-sociometry
- Strategies to facilitate group learning.

**Suggestive Practicum**

- Spending day with a child and preparing a report based on our observations of children for: A day from different economic status (low and affluent)
- Focus on various factors: Physical, emotional, social, language, cultural and religious influencing the child on daily basis.
- Observing children to understand the styles of children learning process.
- Identifying the Learning Difficulties of Students in Different learning areas and the Possible Reason for them- Case Study Report.
- Preparing Personalized Intervention plan for Students with Learning Difficulties.
- Plan to use advanced technology to encourage talented / gifted children.
- Encouraging gifted / talented students beyond the general school curriculum.
- Familiarization and Reporting of Individual Psychological Tests.

**Suggestive Mode of Transaction**

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

**Suggestive Mode of Assessment**

The assessment will be based on the tests and assignments.

**Suggestive Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning content.

**DCBO-301: Diversity of Seed Plants (Gymnosperms and Palaeobotany)**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.

- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –

1. Sailent features and Characteristics of seed plants.
2. know about the primitive angiosperms
3. analyze the gymnosperms, monocotyledons and di-cotyledons, trees-largest and longest lived seed plants.

**UNIT-I**

General features of gymnosperms, distribution and their classification; Economic importance of gymnosperms

**UNIT-II**

Morphology and anatomy of vegetative and reproductive parts and life cycle:
*Cycas Pinus* and *Ephedra*

**UNIT-III**

Fossil and living seed plants;
Fossil gymnosperms;
Glossopteris, Lengiopteris, Williamsonia, Cycadeoidea
.

**UNIT-IV**

Geological time scale, fossils and fossilization processes, significance of fossils.
Study of the following form genera of fossils

a) Rhynia
b) Calamites

**Suggested Readings**


- Bhatnagar, A.P. and Moitra, A. 1996. Gymnosperms. New Age International Limited, New Delhi.
- Gifford, E.M. and Foster, A.S. 1988. Morphology and Evolution of Vascular Plants. W. H. Freeman & Company, New York.
- Sporne, K.R. 1965. The Morphology of Gymnosperms. Hutchinson & Co. (Publishers) Ltd., London. Stewart, W. M. 1983. Paleobotany and the Evolution of Plants. Cambridge University Press. Cambridge.
- Singh,V., Pandey, P.C.and Jain, D.K.1998-99. Botany, Rastogi Publications, Meerut.


**DCBO-302: Genetics and Plant Breeding**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination: 3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –

1. Know the basic laws of inheritance and variations, various gene interactions.
2. know basics of plant breeding methods and other crop improvement strategies.
3. Process basics of Mutation.

**UNIT-I**

Mendelism: Mendal`s law of inheritance, back cross and test cross, Linkage and crossing over; multiple allelism, gene interaction and modified dihybrid ratio complementary, supplementary, duplicate and epistasis factors.

**UNIT-II**

Chromosome aberrations – deletions, duplication, inversions and translocations; Variations in chromosome number – aneuploidy, euploidy, sex chromosomes.

**UNIT-III**

Gene expression: Structure of gene; transfer of genetic information; proteins. Structure and classification; transcription; translation; regulation of gene expression in prokaryotes and eukaryotes
Genetic variations: Mutations - spontaneous and induced; transposable genetic elements; DNA damage and repair.

**UNIT-IV**

Plant breeding: introduction, objectives of plant breeding, type of plant reproduction: vegetative, sexual and apomixes, their effect on generating and fixing genotype variation, green revolution
Methods of plant improvements: Pureline and mass selection; Hybridization in self and cross pollinated crops, introduction and acclimatization, hybrid vigor and inbreeding depression

**Suggested readings**


- Alberts, B., Bray, D., J., Raff, M., Roberts, K and Watson, I. D. 2001. Molecular Biology of Cell Garland, publishing Co. Inc., New York, USA.

- Atherely,.G., Girton, J. R. and McDonald, J. F. 1999. The Science of Genetics Saunders College Publishing, Fort Worth, USA.
- Gupta, P.K. 1999. A Textbook of Cell and Molecular Biology. Rastogi Publications, Meerut.
- Kleinsmith, L. J. and Kish. V.M. 1995, Principles of Cell and Molecular Biology (3nd edition). Harper Collins College Publishers, New York, USA.
- Lodish, H., Berk, A., Aipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology. W.H. Freeman & Co. New York, USA.
- Russel, P. J. 1998. Genetics. The Benjamin/Cummings Publishing Co. Inc., USA.


**PRACTICALS**

**1. Cycas**

Habit, armour of leaf bases on the stem, very young leaf (circinate vernation) and old foliage leaves, scale leaf, bulbils, male cone, microsporophyll, megasporophyll, and mature seed.

Study through temporary micro preparations or permanent slides – normal root, coralloid root, stem, rachis, leaflet, microsporophyll, pollen grains, and ovule.

**2. Pinus**

Habit, long and dwarf shoot showing cataphylls and scale leaves, T.S. wood showing growth rings, male cones, female cones, and winged seeds.

Study through temporary micro preparations and/or permanent slides – stem (young and old), needle, pollen grains, root, female cone, ovule, embryo (W.M.) showing polycotyledonous condition.

**3. Ephedra**

Habit and structure of whole male and female cones.

Temporary micro preparations and/or permanent slides of node, internode, macerated stem to see vessel structure; epidermal peel mount of vegetative parts to study stomata, male cone, female cone, and pollen grains.

Cytological examination of special types of chromosomes: bar body, lamp brush and polytene chromosomes.

Working out the laws of inheritance using seed mixtures.

Working out the mode of inheritance of linked genes from test cross and or F2 data.

**DCCH-301: General Chemistry-II**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |

| | | | |
|---|---|---|---|
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –

1. Apply the fundamental principles of chemical bonding and their significance in predicting molecular properties..
2. Reflect comprehensive knowledge of solid-state chemistry
3. Analyze and apply the principles of ionic equilibrium to solve problems related to acid-base reactions and precipitation.
4. Reflect upon the functional group approach for the preparation and reactions of Hydrocarbons.
5. Explain the mechanisms and outcomes of various reactions in aliphatic hydrocarbons.
6. Explore the various theories of acids and bases.
7. Apply and perform various chemistry concepts to devlop laboratory skills.

**UNIT – I**

**Chemical Bonding:**

Ionic bond: General characteristics, types of ions, size effects, radius ratio rule and its limitations, Packing of ions in crystals, Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy, Madelung constant, Born-Haber cycle and its application, Solvation energy.

Covalent bond: Lewis structure, Valence Bond theory (Heitler-London approach), Energetic of hybridization, equivalent and non-equivalent hybrid orbitals, Bent's rule, Resonance and resonance energy, Molecular orbital theory, Molecular orbital diagrams of diatomic and simple polyatomic molecules $N_2$, $O_2$, $C_2$, $B_2$, $F_2$, CO, NO, and their ions; HCl, $BeF_2$, $CO_2$, (idea of s-p mixing and orbital interaction to be given), Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding ($\sigma$ and $\pi$ bond approach) and bond lengths, Covalent character in ionic compounds, polarizing power and polarizability, Fajan's rules and consequences of polarization, Ionic character in covalent compounds: Bond moment and dipole moment, Percentage ionic character from dipole moment and electronegativity difference.

**UNIT – II**

**Chemical Bonding and Solid State:**

Metallic Bond: Qualitative idea of valence bond and band theories, Semiconductors and insulators, defects in solids,

Weak Chemical Forces: van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions, Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment) Effects of chemical force, melting and boiling points, solubility energetic of dissolution process.

Solid State: Definition of space lattice, unit cell, Bravais lattices, Law of Crystallography- (i) Law of constancy of interfacial angles (ii) Law of rationality of indices, Weiss and Miller indices (iii) Law of symmetry, symmetry elements in crystals, classification of crystal, X-ray diffraction by crystals, derivation of Bragg equation, determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method).

**UNIT – III**

**Chemistry of Hydrocarbons:**

Alkanes: IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atom in alkanes, Isomerism in alkanes, sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes, Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity.

Cycloalkanes: Nomenclature, methods of formation, chemical reactions Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring, banana bonds.

Alkenes: Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration, The Saytzeff's rule, Hofmann

elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes – mechanism involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$, Polymerization of alkenes, Substitution at the allylic and vinylic positions of alkenes, Industrial applications of ethylene and propene

Cycloalkenes: Methods of formation, conformation and chemical reactions of cycloalkenes; Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes, Structure of allenes and butadiene, methods of formation, polymerization, chemical reaction – 1, 2 and 1, 4 additions, Diels-Alder reaction.

Alkynes: Nomenclature, structure and bonding in alkynes, Methods of formation, Chemical reactions of alkynes, acidity of alkynes, Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation, metal-ammonia reductions, oxidation and polymerization.

**UNIT – IV**

Theories of Acids and Bases: Arrhenius, Bronstred-Lowry, the Lux-Flood, solvent system, Lewis concept of acids and bases, Solvent system of acid and bases with special reference to liquid ammonia, liquid $BrF_3$**,** Concept of Hard and Soft Acids and Bases (HSAB): Classification of acids and bases as hard and soft, Pearson's HSAB concept, acid –base strength and hardness and softness, electronegativity and hardness and softness, Solvent System: Physical properties of a solvent, types of solvent and their general characteristics reactions in non-aqueous solvent with reference to liquid $NH_3$ and liquid $SO_2$.

Ionic equilibrium

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect, dissociation constants of mono-, di-and triprotic acids (exact treatment), Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts, Buffer solutions, derivation of Henderson equation and its applications, buffer capacity, buffer range, buffer action and applications of buffers in analytical chemistry and biochemical processes in the human body, Solubility and solubility product of sparingly soluble salts – applications of solubility product principle, Qualitative treatment of acid – base titration curves (calculation of pH at various stages), Theory of acid–base indicators, selection of indicators and their limitations, Multistage equilibria in polyelectrolyte systems, hydrolysis and hydrolysis constants.

**Suggested Readings:**


1. Lee, J.D. (2010), Concise Inorganic Chemistry, Wiley India.
2. Huheey, J.E.; Keiter, E.A.; Keiter; R. L.; Medhi, O.K. (2009), Inorganic Chemistry-Principles of Structure and Reactivity, Pearson Education.
3. Douglas, B.E.; McDaniel, D.H.; Alexander, J.J. (1994), Concepts and Models of Inorganic Chemistry, John Wiley & Sons.
4. Atkins, P.W.; Overton, T.L.; Rourke, J.P.; Weller, M.T.; Armstrong, F.A. (2010), Shriver and Atkins Inorganic Chemistry, 5th Edition, Oxford University Press.
5. Pfennig, B. W. (2015), Principles of Inorganic Chemistry, John Wiley & Sons.
6. Housecraft, C. E.; Sharpe, A. G., (2018), Inorganic Chemistry, 5th Edition, Pearson.
7. Wulfsberg, G (2002), Inorganic Chemistry, Viva Books Private Limited.
8. Miessler, G.L.; Fischer P.J.; Tarr, D. A. (2014), Inorganic Chemistry, 5th Edition, Pearson.
9. Shiver, D.; Weller, M.; Overton, T.; Rourke, J.; Armstrong, F. (2014), Inorganic Chemistry, 6th Edition, Freeman & Company
10. Das, A. K.; Das, M. (2014), Fundamental Concepts of Inorganic Chemistry, 1st Edition, volume CBS Publishers & Distributors Pvt. Ltd. Practical's:
11. Graham Solomon, T.W., Fryhle, C.B. &Dnyder, S.A. *Organic Chemistry*, John Wiley & Sons (2014).
12. McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
13. Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, Orient Longman, New Delhi (1988).
14. Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.
15. Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.
16. Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry*, S. Chand, 2010.
17. Jeffery, G.H.; Bassett, J.; Mendham, J.; Denney, R.C. (1989), Vogel's Textbook of Quantitative Chemical Analysis, John Wiley and Sons.
18. Harris, D. C.; Lucy,C. A.(2016), Quantitative Chemical Analysis, 9th Edition, Freeman and Company.

19. Physical Chemistry, Puri, Sharma and Pathania, Vishal Publication.
20. Butler, J.N. Ionic Equilibrium: Solubility and pH Calculations, Wiley-Interscience; 1st edition, 1998

**Practical-III (Minor)**

**Credit of the Course**: 1

**Syllabus:**

1. **Quantitative Analysis: Volumetric Analysis**
    a) Determination of acetic acid in commercial vinegar using NaOH.
    b) Determination of alkali content – antacid tablet using HCl.
    c) Estimation of calcium content in chalk as calcium oxalate by permanganometry.
    d) Estimation of ferrous and ferric by dichromate method.
    e) Estimation of copper using thiosulphate.
2. **Functional Group Analysis:** Carboxylic Acid, phenolic, alcohol, carbonyl, amino, amide, nitro, anilide, ester, carbohydrates etc.
3. **Viva-Voce**
4. **Evaluation of record book of experiments performed in semester.**

**DCCH-302: Physical Chemistry-II**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes:** By the end of this course, students will be able to –

1. Identify the concepts of Electrolytic and electrochemical cell, electrochemical series, standard electrode potential.
2. Apply various spectral techniques to understand molecular strauctre of various compounds
3. Reflect about photochemistry, laws of photochemistry and photochemical reactions.
4. Perform and demonstrate various concepts involved in quantitative analysis and Thermochemistry.

**UNIT-I**

**Electrochemistry-**

Quantitative aspects of Faraday's laws of electrolysis, rules of oxidation/reduction of ions based on half-cell potentials, applications of electrolysis in metallurgy and industry, Chemical cells, reversible and irreversible cells with examples, Electromotive force of a cell and its measurement, Nernst equation, Standard electrode (reduction) potential and its application to different kinds of half-cells, Application of EMF measurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) Ph values, using hydrogen, quinone-hydroquinone, glass and $SbO/Sb_2O_3$ electrodes, Concentration cells with and without transference, liquid junction potential, determination of activity coefficients and transference numbers, Qualitative discussion of potentiometric titrations (acid-base, redox, precipitation).

**UNIT- II**

**Fundamentals of Spectroscopy-I**

Interaction of electromagnetic radiation with molecules and various types of spectra, Born-Oppenheimer approximation, Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies, Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches.

**UNIT- III**

**Fundamentals of Spectroscopy-II**

Raman spectroscopy: Qualitative treatment of Rotational Raman effect, Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines, their intensity difference, rule of mutual exclusion, Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states, fluorescence and phosphorescence, dissociation and predissociation, calculation of electronic transitions of polyenes using free electron model.

Electron Spin Resonance (ESR) spectroscopy: Its principle, hyperfine structure, ESR of simple radicals

**UNIT-IV**

**Photochemistry:**

Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients, Laws of photochemistry, quantum yield, actinometry, examples of low and high quantum yields, photochemical equilibrium and the differential rate of photochemical reactions, photosensitized reactions, quenching, Role of photochemical reactions in biochemical processes, photostationary states, chemiluminescence

**Suggested Readings:**


1. Modern Aspects of Electrochemistry (Vol. I & II), A.K.N. Reddy, Plenum Press, New York.
2. Physical Chemistry, Puri, Sharma and Pathania, Vishal Publication.
3. Physical Chemistry, Beli & Tuli, S. chand Publication, Delhi.
4. Fundamentals of Molecular Spectroscopy by CN Banwell and EM McCash, Tata McGraw Hill.
5. Modern Spectroscopy, J.M. Hollas, John Wiley
6. Introduction to Molecular Spectroscopy, G.M. Barrow, McGraw Hill.
7. Basic Principles of Spectroscopy, R. Chang, McGraw Hill. Theory and Applications of UV Spectroscopy, H.H. Jaffe and M. Orchin, IBH- Oxford
8. Turro, N. J. Modern Molecular Photochemistry Univ. Science Books (1991).
9. Gilbert, A. & Baggot, J. Essentials of Molecular Photochemistry Blackwell Scientific (1990)
10. Photochemistry, J.G.Cavert and J.N.Pitts, Wiley
11. Fundamentals of Photochemistry, K.K. Rohatgi Mukherji, New Age


**Practical-III (Major)**

**Credit of the Course**: 1

**Syllabus:**

1. **Gravimetric Analysis**

a) Cu as Copper thiocyanate.
b) Ni as Nickel dimethylgloxime

**2. Thermochemistry**

a) Determination of solubility of benzoic acid at different temperatures and determine ΔH of thedissolution process.
b) Determine enthalpy of neutralization of a weak acid/weak base vs strong base / strong acid.
c) Determine the enthalpy of the solution of solid $CaCl_2$ and calculate the lattice energy using Born-Haber Cycle.

2. **Viva-Voce**
3. **Evaluation of record book of experiments performed in semester.**

**DCMA-301: Ordinary Differential Equation**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Ordinary Differential Equations (Minor/Major)**

**Course Learning Outcomes:** After completion of this course the student will be able to:

i) Formulate Differential Equations for various Mathematical models.
ii) Solve second and higher order linear differential equations using various techniques.
iii) Apply these techniques to solve and analyze various mathematical models.

**UNIT-I**

Order and degree of a differential equation, Ordinary differential equations of first order (linear and non-linear): Separable, Linear and reducible to linear, Homogeneous, Exact, Integrating factors, Total Differential Equations,

Orthogonal trajectories, Picard's theorem, examples of non-uniqueness of solutions, First order but higher degree differential equations solvable for x, y, p., Basic concepts of singular solutions, Applications of first order differential equations.

**UNIT-II**

Second and higher order linear differential equations: Basic theory of linear differential equations, Homogeneous linear differential equations with constant coefficients and variable coefficients, Reduction of order, Change of independent variable, Method of undetermined coefficients, Applications of second and higher order differential equations.

**UNIT-III**

Ordinary simultaneous differential equations: Methods for solving ordinary simultaneous differential equations with constant coefficients, Total (or Pfaffian) differential equation.

**UNIT-IV**

Legendre polynomials (first kind), Hypergeometric function, Bessel function, orthogonal set of functions and Strum-Liouville problem.

**Recommended Readings:**


- Advance Differential Equations, Dr. M. D. Raisinghania.
- S.L. Ross, Differential Equations, Wiley, 2007
- G.F. SMATons, Differential Equations with Applications and Historical Notes, McGraw Hill Education, 2017
- Laksmikantham, Deo and Raghavendra, Ordinary differential equations, McGraw Hill Education
- E. A. Coddington, An Introduction to Ordinary Differential Equations, Dover Publications, 1989.


**DCMA-302: Abstract Algebra-II**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

## Abstract Algebra-II

### Unit-I

Introduction of Rings: Definition and examples of rings, Properties of rings, Subrings, Integral domains Definition and examples and fields, characteristic of a ring.

### Unit-II

Ideals, Ideal generated by a subset of a ring, Factor rings, Operations on ideals, Prime and maximal ideals. Polynomial Rings and Unique Factorization Domain: Polynomial rings over commutative rings, Division algorithm and consequences.

### Unit-III

Principal ideal domains, Factorization of polynomials, Reducibility tests, Irreducibility tests, Eisenstein criterion, Unique factorization in Z[x]; Divisibility in integral domains, Irreducibles, Primes, Unique factorization domains, Euclidean domains.

### Unit-IV

Ring Homomorphisms: Ring homomorphisms, Properties of ring homomorphisms, First, Second and Third Isomorphism theorems for rings, The Field of quotients.

**Recommended Readings:**

- Fraleigh, John B. A first course in Abstract Algebra
- Gallian, Joseph. A. (2013). Contemporary Abstract Algebra (8th ed.). Cengage Learning India Private Limited, Delhi. Fourth impression, 2015.
- Topics in Algebra: I.N. Herstein, Wiley Eastern, New Delhi, 2nd ed. 1975.
- Algebra: M. Artin (1991) Prentice Hall.

**Recommended Readings:**

- Topics in Algebra: I.N. Herstein, Wiley Eastern, New Delhi, 2nd ed. 1975.
- Algebra: M. Artin (1991) Prentice Hall.

## DCPY-301: Electricity and Magnetism

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%
- Internal assessment will be as detailed in corresponding course/paper.

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |

| | | | |
|---|---|---|---|
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** Student teachers will be able to:

- Define concepts of electric field.
- Apply the concepts of Gauss's law to solve the problem.
- Distinguish between damped and force oscillation.
- Apply the different concepts of Electric field around conductors to solve the Problems.
- Explain the concept ofElectric fields in matter.
- Explain the concept ofMagnetic fields and Electric Current

**UNIT-I**

Electric Field: Coulomb's law, unit of charge, Conservation and quantization of charge, Field due to different charge distributions, monopole, dipole, quadrupoles, line charge, sheet charge, Torque on a dipole in uniform field and non-uniform fields, flux of an electric field, Gauss's law - applications to deduce E fields, force per unit area on the surface of a charged conductor, Differential form of Gauss's law, Poisson's equation, Laplace's equation, boundary conditions and uniqueness.

Electric Potential: Line integral of electric field and electrical potential, Field as the gradient of potential, Potential energy of a system of charges and its calculation in various configurations, Field equations for E in vacuum.

Electric field around conductors: induced charges, field and potential inside a conductor, field near the surface of a conductor, method of images.

**UNIT-II**

Electric fields in matter: atomic and molecular dipoles, induced dipoles, electronic and molecular contributions, Electrical field caused by polarized matter, E and D fields, permittivity, dielectric constant, Capacitor filled with dielectric, field equations in presence of dielectric, The field of a polarized sphere, dielectric sphere in a uniform field, Energy in dielectric systems, Polarizability and susceptibility, frequency dependence of polarizability, Claussius-Mossotti equation.

**UNIT-III**

Magnetic field: Magnetic field B seen through Lorentz force on a moving charge, unit for B field, magnetic dipoles in atoms and molecules, gyromagnetic ratio, Magnetic field due to currents: Biot and Savart's law, Field equations in magnetostatics, Ampere's law, Fields due to a straight wire, magnetic dipole, circular current and solenoid, Magnetic fields in matter, Magnetizing current, magnetization vector, H and B fields, magnetic permeability, susceptibility, Comparison of magnetostatics and electrostatics.

**UNIT-IV**

Electrical current: current density and current, non-steady currents and continuity equations, Electrical conductivity, resistivity, conductance and their temperature dependence.

Varying current, rise and decay of currents in LR and CR circuits, time constant, integrating and differentiating circuits, electrical shielding, Study of a discrete LC transmission line.

Alternating currents: Skin effect for resistance at high frequencies, complex impedance, reactance, impedances of LCR series and parallel circuits, resonance, Q factor, power dissipation and power factor, AC bridges: Anderson's, de Sauty's and Owens bridges, Self and mutual inductance, Measurement of mutual inductance by Carry Foster Method, Coupled circuits and Transformers.

**Suggested Readings:**


- Electricity and Magnetism,A.S. Mahajan and A.A. Rangawala , Tata McGraw Hill.
- Electricity and Magnetism, P. Chakrabarty and K.C.Gupta, New Age International
    - Electricity and Magnetism by K.K. Tewari (S. Chand &Company Limited).

- Electricity and Magnetism (In Hindi) by Bhandari, Kalra and Kakani
- D.J Griffith, "Introduction to electrodynamics", Prentice Hall of India
- E.M. Purcell, Ed. Berkely Physics Course, Vol. 1, Electricity and Magnetism McGraw Hill.
- D. Halliday and R. Resnick, Physics, vol. 2, Wiley Eastern, New Delhi

**Practical:**

- To determine the self-inductance of a coil by Anderson's bridge.
- To compare the two capacities by Desauty's bridge.
- To study the variation of magnetic field along the axis of a current carrying circular coil. Plot the graph and find radius of the coil.
- To study the zener diode in terms of voltage regulation.
- Study of a RC Transmission line at 60 Hz.
- Study of a LC transmission line
  - a fixed frequency (ii) at variable frequency
- Study the Recovery time as a function of frequency of operation and switching current. Recovery time of junction diode and point contact diode.
- Design and study of a Zener/VR tube regulated power supply and study the regulation with various load.
- Study the characteristics of a field effect transistor (FET) and design and study of amplifier of finite gain.
- Study the characteristics of a uni-junction transistor.
- Study the frequency responses of a transistor amplifier (bipolar/FET) obtain the input and output impedance of the amplifier.
- Measurement of Hall coefficient of given material.
- Study of magnetic field due to a current
- Measurement of low resistance by Carey-Foster Bridge.
- Measurement of inductance using impedance at different frequencies.
- Measurement of capacitance using impedance at different frequencies.
- Study of decay of currents in LR and RC circuits.
- Response curve for LCR circuit and resonance frequency and quality factor.
- To determine the frequency of A.C mains

**Suggested Readings:**

- Basic Electronics: A text lab manual, P.B.Zbar, A.P.Malvino, M.A.Miller, 1994, Mc-Graw Hill.
- OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall.
- Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.
- Electronic Devices & circuit Theory, R.L.Boylestad&L.D.Nashelsky, 2009, Pearson
- A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11th Edn, 2011,Kitab Mahal
- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House

## DCPY-302: Solid State Physics

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.

- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| Distribution Marks for the course | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** Student teachers will be able to:

- Discuss the concepts of symmetry and types of lattices.
- Explain different theories of specific heat of solids.
- Classify solids on the basis of band theory.
- Distinguish between diamagnetic, paramagnetic and ferromagnetic materials.
- Discuss the concept of superconductivity and properties of superconductors & high temperature superconductors.

**UNIT-I**

Crystal Structure: Amorphous and Crystalline Materials, Lattice Translation Vectors, Unit Cell, Reciprocal Lattice, Types of Lattices, Brillouin Zones, Types of Bonds- Ionic Bond, Covalent Bond, Van der Waals Bond, Diffraction of x-rays by Crystals-Bragg's Law.

Lattice Vibrations and Phonons :- Linear Monoatomic and Diatomic Chains, Acoustical and Optical branches, Qualitative Description of the Phonon Spectrum in Solids, classical theory of specific heats, Einstein and Debye Theories of Specific Heat of Solids.

**UNIT-II**

Band Theory of Solids: Bloch Theorem, Kronig-Penney Model, Effective Mass of Electron, Concept of Holes, Band Gap, Energy Band Diagram and Classification of Solids, Conductors, Insulators and Semiconductors, Intrinsic and Extrinsic Semiconductors, p- and n- Type Semiconductors, Law of Mass Action, Boltzmann transport equation, Electrical Conductivity and Hall Effect in semiconductors.

**UNIT-III**

Magnetic Properties: Magnetic Properties of Matter, Diamagnetic, Paramagnetic and Ferromagnetic Materials, Classical Langevin Theory of diamagnetic and Paramagnetic materials, Quantum Mechanical Treatment of Paramagnetism, Curie's law, Weiss's theory of Ferromagnetism and Ferromagnetic Domains, B-H Curve, Hysteresis and Energy Loss

**UNIT-IV**

Superconductivity:

Experimental Results, Critical Temperature, Critical magnetic field, Meissner effect, Type I and type II Superconductors, London's Equation and Penetration Depth, Isotope effect, BCS theory, Cooper Pair and Coherence length, Variation of Superconducting Energy Gap with Temperature, Experimental Evidence of Phonons, Josephson Effect, High temperature superconductivity.

**Suggested Readings:**

- Crystalloraphy for Solid State Physics: A. R. Verma and O.N. Srivastava.
- Solid state Physics: R.J. Singh (Pearson).
- Elements of Solid State Physics: J P Srivastava (PHI).
- Superconductivity: Basics and Applications to Magnets: R. G. SHARMA
- Introduction to Solids: Azaroff.

- Solids State Physics: C. Kittel.
- Solids State Physics: Ashcroft and Mermin.
- Solids State Physics: Decker.
- Solid State Physics ---An Introduction to principles of Materials Science: H. Ibach& H. Luth (Springer)

**DCZO-301: Biology of Chordates**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** After successfully completing the course, the students will be able to:

- Develop an understanding of the evolution of vertebrates thus integrating structure, function and development.
- Have an overview of the evolutionary concepts including homology and homoplasy, and detailed discussions of major organ systems.
- Know and appreciate how cells, tissues, and organisms function at different levels

**UNIT-I**

A. An outline classification of chordates up to orders but up to subclasses only in case of proto-chordate groups and mammals.
B. Comparative anatomy of vertebrates from an evolutionary point of view of the following:-
    a) Integument including structure and development of placoid scales, feathers and hair.
    b) Heart and aortic arches.
    c) Kidney and associated urinogenital ducts
C. Habit and habitat, reproduction (excluding development) and affinities to following types:-
    a) Hemichordate: *Banlanoglossus*
    b) Urocohordata: *Herdmania,* ascidians tadpole larva and its metamorphosis.

c) Cephalochordata: *Amphioxus*

**UNIT-II**

Habit, habitat, of the following types:

A. Agnatha: Petromyzon (affinities with other vertebrate groups), affinities of Cyclostomates.
B. Pisces: *Scoliodon* (Digestive system, respiratory system, blood vascular system, urinogenital system, nervous system (central and peripheral) including sense organ)
C. Scales and fins of fishes.

**UNIT-III**

Habit, habitat, structure (morphology, digestive system, respiratory system, blood vascular system, nervous system and urinogenital system of the following types:

A. Amphibia *: Hoplobatrachus tigerinus*
B. Reptilia*: Sara hardwickii*
C. Venomous and non-venomous snakes, poison apparatus and biting mechanism. First aid of snake bite.
D. Parental care in Amphibia.

**UNIT-IV**

Habit, habitat, structure, morophology, digestive system, respiratory system, blood vascular system, nervous system and urinogenital system of the following types:-

A. Aves: *Columba*
B. Mammalia: *Rabbit*.

Origin of birds, migration & flight adaptation of birds.

**Practical:**

1. Study of Museum specimen with respect to levels and patterns of organization, biosystematics, biodiversity, adaptations, development stages, population dynamics, ecological implications etc.
    a. **Hemichordata**: *Balanoglossus*.
    b. **Urochordata**: *Herdmania, Pyrosoma*.
    c. **Cephalochordata**: *Amphioxus.*
    d. **Cyclostomata**: *Petromyzon, Myxine.*
    e. **Pisces**: *Scoliodon, Sphyrna, Torpedo, Pristis, Trygon, Lepidosteus, Clarias, Ophiocephalus, Anabas, Exocoetus, Hippocampus, Tetradon, Protopterus.*
    f. **Amphibia:** *Icthyophis, Necturus, Proteus, Ambystoma, Axolotl larva, Triturus. Amphiuma, Alytes, Bufo.*
    g. **Reptilia:** *Testudo, Trionyx, Sphenodon, Hemidactylus, Draco, Calotes, Chamaeleon, Varanus, Heloderma, Typhlops, Eryx, Hydrophis, Viper, Bungarus, Naja, Alligator;* Identification of Venomous and Non-venomous Snakes.
    h. **Aves:** *Pavo, Columba, Psitacula, Passer, Corvus, Archaeopteryx.*
    i. **Mammals:** *Ornithorhynchus, Echidna, Macropus, Loris, Manis, Rattus*.
2. **Study of Permanent Slides:**
    **a.** ***Balanoglossus****:* T.S. of proboscis, collar region and trunk
    **b.** ***Amphioxus****:* T.S. or oral hood, pharynx
    **c.** **Mammals**: T.S. of skin, stomach, duodenum, ileum, liver, Pancreas, spleen, lungs, kidney, Testis, Ovary.
3. **Osteology:**
    **a.** Study of skull bone of Frog, *Varanus*, Bird and Rabbit.
    **b.** Study of vertebral of Frog. *Varanus*, Bird and Rabbit.
    **c.** Study of girdles, forelimb and hind limb bones of Frog, *Varanus*, Bird and Rabbit.
4. Dissections and / or its demonstration through Charts / Models / Video / CD / digital alternatives etc and / or preparation of working models of the different system of the following animals.
    a. ***Scoliodon****:* Afferent branchial systems, efferent branchial system, cranial nerves and internal ear.
    b. **Frog**: Digestive, system, Urino-genital system
5. **Permanent /Temporary preparation of the following-:**
    **a.** Scales: Placoid, Cycloid

**b.** Blood film of any vertebrate
**c.** Filoplumes of birds
**d.** Thigh muscles of frog

6. **Microtomy**: Fixing, block making, section cutting, staining, mounting and submission of slides.

**Note:**

- Use of animals for dissection is subject to the conditions that these are not banned under the Wildlife Protection Act or any other legislation
- Students are required to submit the following during examination.
- One assignment on the instrument/ technique about its principle, working, precautions and applications; and /or reagents / solutions preparation.
- Report on study of animals from their natural habitat from their local surroundings. Live Zoology Project Report.

**Suggested Readings:**


- Modern Textbook of Zoology: Vertebrate by R.L. Kotpal – Rastogi Publication, Merrut, 3rd Edition,2008
- A Textbook of Zoology Vol. II by Parkar and Hasswel – (MacMillan)
- A Textbook of Zoology Vol. II by R.D. Vidyarthi – (S. Chand & Co. Delhi)
- Life of Vertebrates by J. Z. Young – (Oxford University Press)
- The Vertebrates by A.S. Romer – (vakils, Ferrer& Simons, Bombay)
- Elements of Chordate Anatomy by Weichert – (McGraw Hill)
- The Birds by R.L. Kotpal (4th Edition) – Rastogi Publications, 2008
- Bird Migration by D.R. Griffin – (Doubleday, Garden city, USA)
- The Book of Indian birds by salim Ali.
- Fish and Fisheries by K. Pandey and J.P. Shukla (2nd Edition) (Rastogi Publication, 2008)
- Indian Fishes by Qureshi – (Brij Brothers., Bhopal)
- Comparative anatomy of the vertebrates by George C Kent- 3rd Saint Louis: The C.V. Mosby Co 1973
- Animal taxonomy and evolution, Dr VS Pawar, Hindi Edition, College book centre, Chaura Rasta Jaipur.


## DCZO-302: Developmental Biology

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |

| | | | |
|---|---|---|---|
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** After successfully completing the course, the students will be able to:

- Develop critical understanding how a single-celled fertilized egg becomes an embryo and then a fully formed adult by going through three important processes of cell division, cell differentiation and morphogenesis.
- Recognize how developmental processes and gene functions within a particular tissue or organism can provide insight into functions of other tissues and organisms.
- Realize that very similar mechanisms are used in very diverse organisms; and development is controlled through molecular changes resulting in variation in the expression and function of gene networks.
- Know how the field of developmental biology has changed since the beginning of the 19th century with different phases of developmental research predominating at different times.
- Process of developmental biology in medicine or its role in development of diseases

**UNIT-I**

A. Concepts and scope of developmental biology
B. Gametogenesis: i) structure and types of spermatozoa, spermatogenesis. ii) structure and types of eggs, oogenesis
C. Fertilization: types, mechanism and significance
D. Cleavage: types and patterns of cleavage, fate map.
E. Gastrulation: morphogenetic movements and significance.

**UNIT-II**

A. Development up to the end of neurulation
B. Metamorphosis of tadpole larva, hormonal control of metamorphosis
C. Development of frog up to formation of advance tadpole.
D. Embryogenesis of chick: development up to neurulation, tabulation.
E. Development of chick according to the hours of incubation – 18 hours, 21 hours, 24 hours, 33 hours, 48 hours, 56 hours, 72 hours, and 96 hours.
F. Extra embryonic membranes of chick – development and functions.

**UNIT-III**

A. Placenta and placentation in mammals.
B. Parthenogenesis: natural and artificial
C. Regeneration mechanism in animals, steps of limb regeneration in amphibians.
D. Stem cells and their significance.

**UNIT-IV**

A. Elementary idea of the following developmental process
   a) Embryonic induction
B. ii) Organizer concept
C. iii) Differentiation
D. Teratogenesis : genetic and environmental teratogenesis
E. Ageing and senescence.

**Practical:**

1. Study of types of sperm smears preparation.
2. Study of different types of eggs (insect, frog, hen)
3. Study of life cycle of *Drosophila*.

4. Study of eggs, cleavage, blastula, gastrula, neurula, tail bud, hatching, mature, tadpole larval metamorphic stages of tadpole / forglet.
5. Study of embryological slides of various stages of frog.
6. Study of embryological slides of various stages of chick.
7. Study of development of chick with the help of charts /CD/s /video/ multimedia etc.
    - Whole mounts: 18 hrs, 24 hrs, 33 hrs, 48 hrs, 56 hrs, 72 hrs, and 96 hrs, of incubation period embryos.
    - ii) Study of primitive streak stage in living embryo after removal of the blastoderm from the egg or through multimedia film etc.
    - iii) Study of the embryo at various stages of incubation in vivo by making a window in the egg shell.
    - Frog embryology – study of spawn, identification of different stages through model / charts / multimedia etc.

**Suggested Readings:**


- Development Biology by SF Gilbert, 10th (Sinnauerassciate, 2014)
- Development Biology by K.V. Sastry & Vinita Shukla – (Rastogi publications 2008)
- Introduction to Embryology by B.I. Balinskly – (W.B. Saunders, Philadelphia, 1976)
- Foundations of Embryology by B.M. Paten and B.M. Carison.
- Foundations of Animal Development by A.F. Hopper and N.H. Hart ( Oxford University Press, New York, 1980)
- Vertebrate Embryology by R.S. McEwen ( Oxford & I.B.M Publishing co., New Delhi)
- Development Biology by J.W. Brook Bank.
- Patterns and Principles of Animal Development by J.W. Saunders. Jr
- Embryology by Barth IG (1966) – Holt Rinehart & Winston
- Embryology by Berril N& Karp G ( 1960) -Holt Rinehart & Winston
- Fundamentals of Comparative Embryology of Vertebrates by Huettner AF (1967) – McMillan co.
- Chordate Embryology by Mohan Arora (1985) – Atma Ram &Sons
- Laboratory Manual of Vertebrate Embryology by Rugh R-Allied Pacific P.Ltd
- Chordate Embryology by Verma PS & Agarwal VK –Chand & Co.
- Modern Development Biology, KC Soni Hindi Edition, College Book Centre, Chaura Rasta Jaipur,
- KC Soni Hindi Edition, College Book Centre, Chaura Rasta, Jaipur


## DCSC-301: Nursery and Gardening Techniques

| | |
|---|---|
| Credits: 2L+0T+1P | Marks 75 |
| Contact hours per week: 5 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| Distribution Marks for the course | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |
| **Total Marks** | 75 | | 30 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –

1. Know the basic concepts of nursery and gardening, the objectives and scope of different types of gardening.
2. Process of role of seed and its dormancy.
3. Explain different techniques of vegetative propagation.

**UNIT: I**

Nursery: definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities- Planting - direct seeding and transplants.

**UNIT: II**

Seed: Structure and types - Seed dormancy; causes and methods of breaking dormancy-Seed storage Seed bunks, factors affecting seed viability, genetic erosion - Seed production technology - seed testing and certification

**UNIT: III**

Vegetative propagation: air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings - Hardening of plants- green house mist chamber. shed root, shade house and glass house

**UNIT: IV**

Gardening definition, objectives and scope different types of gardening-landscape and home gardening, parks and its components plant materials and design-computer applications in landscaping, Gardening operations soil lavine manuring watering, management

**Suggested readings:**


- Ratha Krishnan, M., et.al. (2014) Plant nursery management: Principles and practices, Central
- Arid Zone Research Institute (ICAR), Jodhpur, Rjasthan
- Kumar, N., (1997) Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
- Kumar Mishra, K., N.K. Mishra and Satish Chand (1994) Plant Propagation, John Wiley & Sons, New Jersey


**PRACTICALS**

**Course Content:**

- Demonstration of nursery bed making.
- Demonstration of preparation of media for nursery.
- Hands on training on vegetative propagation techniques.
- Hands on training on sowing methods of seeds and other material.
- Visit to an agriculture/horticulture /forest nursery.
- Case study on establishment and success of a plant nursery.

**DCSC-302: Applications of Computers in Chemistry**

| | |
|---|---|
| Credits: 2L+0T+1P | Marks 75 |
| Contact hours per week: 5 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |
| **Total Marks** | **75** | | **30** |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes:** By the end of this course, students will be able to –

1. Analyze and interpret chemical data using computer-based tools and software.
2. Demonstrate proficiency in using computational chemistry techniques to predict molecular structures, properties, and interactions.
3. Apply computer programming skills to automate data analysis and perform simulations.
4. Utilize molecular visualization software to communicate complex chemical concepts and results effectively.
5. Evaluate and select appropriate software and tools for specific chemistry-related tasks, considering their accuracy, efficiency, and applicability.
6. Critically assess the ethical and security implications of using computers in chemistry, including data privacy and intellectual property considerations.

**UNIT-I**

Basic Computer system (in brief)-Hardware and Software; Input devices, Storage devices, Output devices, Central Processing Unit (Control Unit and Arithmetic Logic Unit); Number system (Binary, Octal and Hexadecimal Operating System); Computer Codes (BCD and ASCII); Numeric/String constants and variables. Operating Systems (DOS, WINDOWS, and Linux); Software languages: Low level and High Level languages (Machine language, Assembly language; QBASIC, FORTRAN and C++); Software Products (Office, chemsketch, scilab, matlab, hyperchem, etc.), internet application.

**UNIT-II**

Use of Programming Language for solving problems in Chemistry: Computer Programming Language- QBASIC, (for solving some of the basic and in turn complicated chemistry problems). QB4 version of QBASIC can be used. Programming Language – QBASIC; Commands: INPUT and PRINT Commands; GOTO, If, ELSEIF, THEN and END IF Commands; FOR and NEXT Commands; Library Functions ( ABS, ASC, CHR$, EXP,INT, LOG, RND, SQR, TAB and trigonometric Functions), DIM, READ, DATA, REM, RESTORE, DEF FNR, GOSUB, RETURN, SCREEN, VIEW, WINDOW, LINE, CIRCLE. LOCATE, PSET Commands. Simple programs using above mentioned commands.

**UNIT-III**

QBASIC programs for Chemistry problems - Example: plotting van der Waal Isotherms (Simple Problem, available in general textbooks) and observe whether van der Waal gas equation is valid at temperatures lower than critical temperature where we require to solve a cubic equation and calculation of area under the curves (Complicated Problem, not available in general textbooks), Solution of quadratic equation, polynomial equations (formula, iteration and Newton – Raphson methods, binary bisection and Regula Falsi); Numerical differential, Numerical integration (Trapezoidal rule), Simultaneous equations, Matrix addition and multiplication, Statistical analysis.

**UNIT-IV**

Use of Software Products: Computer Software like Scilab, Excel, etc to solve some of the plotting or calculation problems, Basic idea of Molecular Modelling using software like chemsketch, arguslab and Accelerys JDraw etc for geometry optimization and potential energy surface (local and global minima)

**Suggested Readings:**


- McQuarrie, D. A. Mathematics for Physical Chemistry University Science Books (2008).
- Mortimer, R. Mathematics for Physical Chemistry. 3rd Ed. Elsevier (2005).
- Steiner, E. The Chemical Maths Book Oxford University Press (1996).
- Yates, P. Chemical Calculations. 2nd Ed. CRC Press (2007).
- Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007) Chapters 3-5.
- Levie, R. de, How to use Excel in analytical chemistry and in general scientific data analysis, Cambridge Univ. Press (2001) 487 pages.
- Noggle, J. H. Physical Chemistry on a Microcomputer. Little Brown & Co. (1985).
- Venit, S.M. Programming in BASIC: Problem solving with structure and style. Jaico Publishing House: Delhi (1996)


**DCSC-303: Discrete Mathematics**

| | |
|---|---|
| Credits: 2L+1T+0P | Marks 75 |
| Contact hours per week: 5 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 4 |
| Internal Test (C2) | 10+5 | 1hr | 6 |
| External Examinations: Theory | 50 | 3hr | 20 |
| **Total Marks** | **75** | | **30** |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Discrete Mathematics (Skill Enhancement Course)**

**Course Learning Outcomes:** After completion of this course the student will be able to:

- Lattices and their types;
- Boolean algebra, switching circuits and their applications;
- Graphs, their types and its applications in study of shortest path algorithms.

**UNIT-I**

Ordered Sets: Definitions, Examples and basic properties of ordered sets, Order isomorphism, Hasse diagrams, Dual of an ordered set, Duality principle, Maximal and minimal elements, Building new ordered sets, Maps between ordered sets.

**UNIT–II**

Lattices: Lattices as ordered sets, Lattices as algebraic structures, Sublattices, Products and homomorphisms; Definitions, Examples and properties of modular and distributive lattices.

**UNIT-III**

Boolean Algebras and Switching Circuits: Boolean Algebras, De Morgan's laws, Boolean homomorphism, Representation theorem; Boolean polynomials, Boolean polynomial functions, Disjunctive normal form and conjunctive normal form, Minimal forms of Boolean polynomial.

**UNIT-IV**

Graph Theory: Introduction to graphs, Konigsberg Bridge problem, Instant insanity game; Definition, examples and basic properties of graphs, Subgraphs, Pseudographs, Complete graphs, Bipartite graphs, Isomorphism of graphs, Paths and circuits, Eulerian circuits, Hamiltonian cycles, Adjacency matrix, Weighted graph, Travelling salesman problem, Shortest path.

**Recommended Readings:**


1. Davey, B. A., & Priestley, H. A. (2002). Introduction to lattices and order (2nd ed.). Cambridge University press, Cambridge.
2. Goodaire, Edgar G., & Parmenter, Michael M. (2011). Discrete Mathematics with graph theory (3rd ed.). Pearson Education (Singapore ) Pvt. Ltd. Indian Reprint.
3. Lidl, Rudolf & Pilz, Gunter. (2004). Applied Abstract Algebra (2nd ed.), Undergraduate Texts in Mathematics. Springer (SIE). Indian Reprint.


**DCSC-304: Physics Laboratory and Wood Workshop Skills**

| | |
|---|---|
| Credits: 2L+0T+1P | Marks 75 |
| Contact hours per week: 5 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| Distribution Marks for the course | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |
| **Total Marks** | **75** | | **30** |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:**

On completion of the course, the student teacher will be able to-

- Recognize and use different tools/materials/instruments.
- Read the sketch/drawing of the job/project.
- Develop the skills for making simple projects/models.
- Acquire skill to assemble/prepare simple electric circuits.
- Acquire skill to use electronic components.
- Identify faults in electronic components.
- Develop the ability in repairing simple instruments used at secondary level.
- Inculcate healthy values related to work culture.

**UNIT I**

Measuring devices: Vernier calliper, Screw gauge and travelling microscope. Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. Use of Sextant to measure height of buildings, mountains, etc.

**UNIT II**

Introduction to Woodworking: Safety guidelines, types of wood and their characteristics, basic hand tools and power tools.

**UNIT III**

Woodworking Techniques: Measuring, marking, and cutting wood, joinery methods (e.g., butt joints, dovetail joints), sanding and finishing.

**UNIT IV**

Furniture Building Basics: Design principles for functional furniture, constructing a small-scale furniture piece such as a side table or chair.

**Suggested Readings:**


- Mechanical workshop practice, K.C. John, 2010, PHI Learning Pvt. Ltd.
- Workshop Processes, Practices and Materials, Bruce J Black 2005, 3rd Edn., Editor Newnes [ISBN: 0750660732] New Engineering Technology, Lawrence Smyth/Liam Hennessy, The Educational Company of Ireland [ISBN0861674480].
- The Essential guide to Woodwork, Chris simpson, 2001, Murdoch.
- The Complete Manual of Woodworking, Albert Jackson, David Day, 2019, Alfred A. Knopf.


**Practical:**

- Preparation of Projects/Models based on the following (Only Suggestive)
- Comparison of diameter of a thin wire using screw gauge and travelling microscope.
- Drilling of Hole in metal, wood and plastic.
- Cutting of wood pieces.
- Joining of wood pieces.
- Constructing a small-scale furniture piece such as a side table or chair or any other item.

**Modes of Learning Engagement**: Constructivist Approach: Hands on Experiences, Activity based Learning, Experimentation, and Interactive engagement. Group Work, Peer Learning, Project Work.

**DCSC-305: Livestock Management**

| | |
|---|---|
| Credits: 2L+0T+1P | Marks 75 |
| Contact hours per week: 5 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |
| **Total Marks** | 75 | | 30 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** After successfully completing the course, the students will be able to:

- Learn about protein metabolism and nutritional recommendations for various stages of the lactating mother and diet preparation techniques.
- Acquire the skills to manage a dairy farm or to start one with adequate inputs.
- Livestock Management courses focus on using biological and chemical concepts to produce and maintain livestock animals as well as produce and handle products.

**UNIT-I**

a) Scope of Livestock Industry; Livestock Enterprises; Issues in Animal Agriculture. Animal Products: Importance of Animal Products; Beef; Pork; Lamb; Poultry Products. Advanced Reproduction and Breeding: Reproductive Systems, Common Breeding Systems including cattle Breeding, Swine, Sheep and Goat Breeding, Hormones and Cycles and effect of environment. Reproductive Technologies.
b) Environment and facilities: Expertise, Animals Dairy herd health and production; Managing Dairy Cattle. Breed selection: Breeds of cattle and buffalo, Native cow varieties, Indian exotic breeds their popularity and performance; Forage Production and Pasture Management.
c) Nutritional requirements, Sources of feed: Temperate and tropical grasses. Feed composition– nutrients for milk production, Water Energy, Protein, Fibre, Energy and digestibility, Vitamins.

**UNIT-II**

a) Housing and Maternity Management: Housing of Dairy Cattle. Dairy and shed design. Cooling strategies, Cow comfort Management; Cleaning Management.

b) Animal signs Management. Dairy herd Management and growth; Cow health and reproductive performance.
c) Breeding Dairy Cattle. Artificial insemination and conception; Maternity management, The Lactation Cycle.
d) Calf management, Calf diseases; Common management procedures. Vaccination, dehorning, weaning etc.

**UNIT-III**

a) Milk Products Management: Milk Products: Cheese, yogurt, gluten etc. Milking Management.
b) Gathering cow for milking; Milking machines for smallholders; cleaning and sanitizing dairy equipment; Milking procedure.
c) Dry cow therapy; Milk filtration Management. Milking Hygiene; Post-harvest milk quality.

**UNIT-IV**

a) Business prospects, Biosecurity: Dairy business profit strategies.
b) Common disorders in Dairy Cattle; Managing Dairy Facilities for sick and lame cows. Mastitis, metabolic disorders, hypermagnesemia, ketosis and fatty liver, Ruminal acidosis, metritis; Hoof management.
c) Manure handling. Cow Longevity; Dairy buffalo Production Management, Biosecurity; Farm level economics affecting productivity and profitability.
d) Planning and Marketing; Culling, Forward Contracting, Backgrounding. Quality control; Future prospects. Basic principles of Genetics and tools for genetic improvement. Current issues affecting the livestock industry.

**Practical:**

- Visit to the animal farm (poultry and goatary etc.), Identification of common tools used on animal farm.
- Demonstration of body parts and reproductive organs of chicks.
- Estimation of casein content in sheep/goat milk.
- Comparative biochemical assay of nutrient contents of different livestock animals.
- Modern equipments & techniques to enhance the production and income via livestock production.
- Identification of various breeds of cattle, buffalo, sheep and goat Familiarization with body points of animals.
- Approaching, handling and restraining of cattle, buffalo, sheep and goat Clipping, shearing, dipping, spraying and spotting sick animals.
- Detection of vices. Feeding of animals. Methods of identification (marking, tattooing, branding, tagging and electronic chip).
- Determination of age. Determination of body weight using different measurements.
- Layout plans for dairy and sheep/goat farms. Familiarization with routine farm operations. Selection and culling of animals. Milking of dairy animals. Training of breeding mates. Detection of heat Identification and care of pregnant animals. Care of neonatal and young stock. Maintenance, cost accounting, economic analysis and preparation of balance sheet of dairy and sheep/goat farm records. Structure of wool and its differentiation from hair fibre. Determination of staple length, crimps, diameter and strength of wool fibre. Sorting, packaging and grading of wool. Recovery of wax from wool. Scouring and carbonisation of wool

**Suggested Readings:**


- Klaus, A. J. (2015) Dairy Farming: The Beautiful Way
- Leitch, A. (2018) The Dairy Farm: Dairy Cattle Methods, and Dairy Farm Management
- Sastry, N.S.R. and Thomas, C.K. (2005) Livestock Production Management 4th Ed.
- Thomas, C.K. and Sastry, N.S.R (1991) Dairy Bovine Production
- Cockrill, R.W. (1974) The Husbandry and Health of the Domestic Buffalo
- Ensminger, M.E. (2002) Sheep and Goat Science, 6th Ed.
- Clutton Brock, J. (2004)A Natural History of Domesticated Mammals, 2nd Ed.
- Watson, J.A.S. and Mills, W.J. (2005) Farm Animals and their Management
- Taylor, R.E. and Field, T.G. (1977) Scientific Farm Animal Production
- Pagot, J. (1992) Animal Production in the Tropics and Sub-tropics
- Mason, I.L. (1988) World Dictionary of Livestock Breeds, 3rd Ed.

- Anderson, R.H. and Edney, A.T.B. (1991) Practical Animal Handling

**DCBO-301: Genetics and Plant Breeding**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –

- Explain the basic laws of inheritance and variations.
- Know various gene interactions.
- Process of basics of plant breeding methods and other crop improvement strategies.
- Process basics of Mutation.

**UNIT- I**

**Mendelism:** Mendal`s law of inheritance, back cross and test cross, Linkage and crossing over; multiple allelism, gene interaction and modified dihybrid ratio complementary, supplementary, duplicate and epistasis factors

**UNIT- II**

Chromosome aberrations – deletions, duplication, inversions and translocations; Variations in chromosome number – aneuploidy, euploidy, sex chromosomes.

**UNIT- III**

Gene expression: Structure of gene; transfer of genetic information; proteins. Structure and classification; transcription; translation; regulation of gene expression in prokaryotes and eukaryotes

Genetic variations: Mutations - spontaneous and induced; transposable genetic elements; DNA damage and repair.

**UNIT- IV**

**Plant breeding:** introduction, objectives of plant breeding, type of plant reproduction: vegetative, sexual and apomixes, their effect on generating and fixing genotype variation, green revolution

Methods of plant improvements: Pureline and mass selection; Hybridization in self and cross pollinated crops, introduction and acclimatization, hybrid vigor and inbreeding depression

**Suggested readings**


- Alberts, B., Bray, D., J., Raff, M., Roberts, K and Watson, I. D. 2001. Molecular Biology of Cell Garland, publishing Co. Inc., New York, USA.
- Atherely,.G., Girton, J. R. and McDonald, J. F. 1999. The Science of Genetics Saunders College Publishing, Fort Worth, USA.
- Gupta, P.K. 1999. A Textbook of Cell and Molecular Biology. Rastogi Publications, Meerut.
- Kleinsmith, L. J. and Kish. V.M. 1995, Principles of Cell and Molecular Biology (3nd edition). Harper Collins College Publishers, New York, USA.
- Lodish, H., Berk, A., Aipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology. W.H. Freeman & Co. New York, USA.
- Russel, P. J. 1998. Genetics. The Benjamin/Cummings Publishing Co. Inc., USA. 63


**Practical**

- Cytological examination of special types of chromosomes: bar body, lamp brush and polytene chromosomes.
- Working out the laws of inheritance using seed mixtures.
- Working out the mode of inheritance of linked genes from test cross and or F2 data.

**DCCH-301: General Chemistry-II**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)

C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –

- Apply the fundamental principles of chemical bonding and their significance in predicting molecular properties..
- Reflect comprehensive knowledge of solid-state chemistry
- Analyze and apply the principles of ionic equilibrium to solve problems related to acid-base reactions and precipitation.
- Reflect upon the functional group approach for the preparation and reactions of Hydrocarbons.
- Explain the mechanisms and outcomes of various reactions in aliphatic hydrocarbons.
- Explore the various theories of acids and bases.
- Apply and perform various chemistry concepts to devlop laboratory skills.

**UNIT – I**

**Chemical Bonding:**

Ionic bond: General characteristics, types of ions, size effects, radius ratio rule and its limitations, Packing of ions in crystals, Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy, Madelung constant, Born-Haber cycle and its application, Solvation energy.

Covalent bond: Lewis structure, Valence Bond theory (Heitler-London approach), Energetic of hybridization, equivalent and non-equivalent hybrid orbitals, Bent's rule, Resonance and resonance energy, Molecular orbital theory, Molecular orbital diagrams of diatomic and simple polyatomic molecules $N_2$, $O_2$, $C_2$, $B_2$, $F_2$, CO, NO, and their ions; HCl, $BeF_2$, $CO_2$, (idea of s-p mixing and orbital interaction to be given), Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding ($\sigma$ and $\pi$ bond approach) and bond lengths, Covalent character in ionic compounds, polarizing power and polarizability, Fajan's rules and consequences of polarization, Ionic character in covalent compounds: Bond moment and dipole moment, Percentage ionic character from dipole moment and electronegativity difference.

**UNIT – II**

**Chemical Bonding and Solid State:**

Metallic Bond: Qualitative idea of valence bond and band theories, Semiconductors and insulators, defects in solids,

Weak Chemical Forces: van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions, Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment) Effects of chemical force, melting and boiling points, solubility energetic of dissolution process.

Solid State: Definition of space lattice, unit cell, Bravais lattices, Law of Crystallography- (i) Law of constancy of interfacial angles (ii) Law of rationality of indices, Weiss and Miller indices (iii) Law of symmetry, symmetry elements in crystals, classification of crystal, X-ray diffraction by crystals, derivation of Bragg equation, determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method).

**UNIT – III**

**Chemistry of Hydrocarbons:**

Alkanes: IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atom in alkanes, Isomerism in alkanes, sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes, Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity.

Cycloalkanes: Nomenclature, methods of formation, chemical reactions Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring, banana bonds.

Alkenes: Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration, The Saytzeff's rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes – mechanism involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$,

Polymerization of alkenes, Substitution at the allylic and vinylic positions of alkenes, Industrial applications of ethylene and propene

Cycloalkenes: Methods of formation, conformation and chemical reactions of cycloalkenes; Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes, Structure of allenes and butadiene, methods of formation, polymerization, chemical reaction – 1, 2 and 1, 4 additions, Diels-Alder reaction.

Alkynes: Nomenclature, structure and bonding in alkynes, Methods of formation, Chemical reactions of alkynes, acidity of alkynes, Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation, metal-ammonia reductions, oxidation and polymerization.

**UNIT – IV**

**Theories of Acids and Bases:**

Arrhenius, Bronstred-Lowry, the Lux-Flood, solvent system, Lewis concept of acids and bases, Solvent system of acid and bases with special reference to liquid ammonia, liquid $BrF_3$**,** Concept of Hard and Soft Acids and Bases (HSAB): Classification of acids and bases as hard and soft, Pearson's HSAB concept, acid –base strength and hardness and softness, electronegativity and hardness and softness, Solvent System: Physical properties of a solvent, types of solvent and their general characteristics reactions in non-aqueous solvent with reference to liquid $NH_3$ and liquid $SO_2$.

**Ionic equilibrium**

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect, dissociation constants of mono-, di-and triprotic acids (exact treatment), Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts, Buffer solutions, derivation of Henderson equation and its applications, buffer capacity, buffer range, buffer action and applications of buffers in analytical chemistry and biochemical processes in the human body, Solubility and solubility product of sparingly soluble salts – applications of solubility product principle, Qualitative treatment of acid – base titration curves (calculation of pH at various stages), Theory of acid–base indicators, selection of indicators and their limitations, Multistage equilibria in polyelectrolyte systems, hydrolysis and hydrolysis constants.

**Suggested Readings:**


- Lee, J.D. (2010), Concise Inorganic Chemistry, Wiley India.
- Huheey, J.E.; Keiter, E.A.; Keiter; R. L.; Medhi, O.K. (2009), Inorganic Chemistry-Principles of Structure and Reactivity, Pearson Education.
- Douglas, B.E.; McDaniel, D.H.; Alexander, J.J. (1994), Concepts and Models of Inorganic Chemistry, John Wiley & Sons.
- Atkins, P.W.; Overton, T.L.; Rourke, J.P.; Weller, M.T.; Armstrong, F.A. (2010), Shriver and Atkins Inorganic Chemistry, 5th Edition, Oxford University Press.
- Pfennig, B. W. (2015), Principles of Inorganic Chemistry, John Wiley & Sons.
- Housecraft, C. E.; Sharpe, A. G., (2018), Inorganic Chemistry, 5th Edition, Pearson.
- Wulfsberg, G (2002), Inorganic Chemistry, Viva Books Private Limited.
- Miessler, G.L.; Fischer P.J.; Tarr, D. A. (2014), Inorganic Chemistry, 5th Edition, Pearson.
- Shiver, D.; Weller, M.; Overton, T.; Rourke, J.; Armstrong, F. (2014), Inorganic Chemistry, 6th Edition, Freeman & Company
- Das, A. K.; Das, M. (2014), Fundamental Concepts of Inorganic Chemistry, 1st Edition, volume CBS Publishers & Distributors Pvt. Ltd. Practical's:
- Graham Solomon, T.W., Fryhle, C.B. &Dnyder, S.A. *Organic Chemistry*, John Wiley & Sons (2014).
- McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
- Sykes, P. *A Guidebook to Mechanism in Organic Chemistry,* Orient Longman, New Delhi (1988).
- Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.
- Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.
- Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry,* S. Chand, 2010.
- Jeffery, G.H.; Bassett, J.; Mendham, J.; Denney, R.C. (1989), Vogel's Textbook of Quantitative Chemical Analysis, John Wiley and Sons.
- Harris, D. C.; Lucy,C. A.(2016), Quantitative Chemical Analysis, 9th Edition, Freeman and Company.

- Physical Chemistry, Puri Sharma nad Pathania, Vishal Publication.
- Butler, J.N. Ionic Equilibrium: Solubility and pH Calculations, Wiley-Interscience; 1st edition, 1998

**Practical-III (Minor)**

**Credit of the Course**: 1

**Syllabus:**

1. Quantitative Analysis: Volumetric Analysis
    f) Determination of acetic acid in commercial vinegar using NaOH.
    g) Determination of alkali content – antacid tablet using HCl.
    h) Estimation of calcium content in chalk as calcium oxalate by permanganometry.
    i) Estimation of ferrous and ferric by dichromate method.
    j) Estimation of copper using thiosulphate.
2. Functional Group Analysis: Carboxylic Acid, phenolic, alcohol, carbonyl, amino, amide, nitro, anilide, ester, carbohydrates etc.
3. Viva-Voce
4. Evaluation of record book of experiments performed in semester.

**DCMA-301: Ordinary Differential Equation**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Ordinary Differential Equations (Minor/Major)**

**Course Learning Outcomes:** After completion of this course the student will be able to:

- Formulate Differential Equations for various Mathematical models.
- Solve second and higher order linear differential equations using various techniques.
- Apply these techniques to solve and analyze various mathematical models.

**UNIT-I**

Order and degree of a differential equation, Ordinary differential equations of first order (linear and non-linear): Separable, Linear and reducible to linear, Homogeneous, Exact, Integrating factors, Total Differential Equations, Orthogonal trajectories, Picard's theorem, examples of non-uniqueness of solutions, First order but higher degree differential equations solvable for x, y, p., Basic concepts of singular solutions, Applications of first order differential equations.

**UNIT-II**

Second and higher order linear differential equations: Basic theory of linear differential equations, Homogeneous linear differential equations with constant coefficients and variable coefficients, Reduction of order, Change of independent variable, Method of undetermined coefficients, Applications of second and higher order differential equations.

**UNIT-III**

Ordinary simultaneous differential equations: Methods for solving ordinary simultaneous differential equations with constant coefficients, Total (or Pfaffian) differential equation.

**UNIT-IV**

Legendre polynomials (first kind), Hypergeometric function, Bessel function, orthogonal set of functions and Strum-Liouville problem.

**Recommended Readings:**


- Advance Differential Equations, Dr. M. D. Raisinghania.
- S.L. Ross, Differential Equations, Wiley, 2007
- G.F. SMATons, Differential Equations with Applications and Historical Notes, McGraw Hill Education, 2017
- Laksmikantham, Deo and Raghavendra, Ordinary differential equations, McGraw Hill Education
- E. A. Coddington, An Introduction to Ordinary Differential Equations, Dover Publications, 1989.


**DCPY-301: Electricity and Magnetism**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** Student teachers will be able to:

- Explain the concept of electric field and electric potential.
- Discuss the concept of Gauss's law in reference to electrostatics.
- Explain the concept of Electric fields in matter.
- Explain the concept of Magnetic fields and Electric Current.

**UNIT-I**

Electric Field: Coulomb's law, unit of charge, Conservation and quantization of charge, Field due to different charge distributions, monopole, dipole, quadrupoles, line charge, sheet charge, Torque on a dipole in uniform field and non-uniform fields, flux of an electric field, Gauss's law - applications to deduce E fields, force per unit area on the surface of a charged conductor, Differential form of Gauss's law, Poisson's equation, Laplace's equation, boundary conditions and uniqueness.

Electric Potential: Line integral of electric field and electrical potential, Field as the gradient of potential, Potential energy of a system of charges and its calculation in various configurations, Field equations for E in vacuum.

Electric field around conductors: induced charges, field and potential inside a conductor, field near the surface of a conductor, method of images.

**UNIT-II**

Electric fields in matter: atomic and molecular dipoles, induced dipoles, electronic and molecular contributions, Electrical field caused by polarized matter, E and D fields, permittivity, dielectric constant, Capacitor filled with dielectric, field equations in presence of dielectric, The field of a polarized sphere, dielectric sphere in a uniform field, Energy in dielectric systems, Polarizability and susceptibility, frequency dependence of polarizability, Claussius-Mossotti equation.

**UNIT-III**

Magnetic field: Magnetic field B seen through Lorentz force on a moving charge, unit for B field, magnetic dipoles in atoms and molecules, gyromagnetic ratio, Magnetic field due to currents: Biot and Savart's law, Field equations in magnetostatics, Ampere's law, Fields due to a straight wire, magnetic dipole, circular current and solenoid, Magnetic fields in matter, Magnetizing current, magnetization vector, H and B fields, magnetic permeability, susceptibility, Comparison of magnetostatics and electrostatics.

**UNIT-IV**

Electrical current: current density and current, non-steady currents and continuity equations, Electrical conductivity, resistivity, conductance and their temperature dependence.

Varying current, rise and decay of currents in LR and CR circuits, time constant, integrating and differentiating circuits, electrical shielding, Study of a discrete LC transmission line.

Alternating currents: Skin effect for resistance at high frequencies, complex impedance, reactance, impedances of LCR series and parallel circuits, resonance, Q factor, power dissipation and power factor, AC bridges: Anderson's, de Sauty's and Owens bridges, Self and mutual inductance, Measurement of mutual inductance by Carry Foster Method, Coupled circuits and Transformers

**Suggested Readings:**


- Electricity and Magnetism,A.S. Mahajan and A.A. Rangawala , Tata McGraw Hill.
- Electricity and Magnetism, P. Chakrabarty and K.C.Gupta, New Age International
- Electricity and Magnetism by K.K. Tewari (S. Chand &Company Limited).
- Electricity and Magnetism (In Hindi) by Bhandari, Kalra and Kakani
- D.J Griffith, "Introduction to electrodynamics", Prentice Hall of India
- E.M. Purcell, Ed. Berkely Physics Course, Vol. 1, Electricity and Magnetism McGraw Hill.
- D. Halliday and R. Resnick, Physics, vol. 2, Wiley Eastern, New Delhi

**Practical:**

- To determine the self-inductance of a coil by Anderson's bridge.
- To compare the two capacities by Desauty's bridge.
- To study the variation of magnetic field along the axis of a current carrying circular coil. Plot the graph and find radius of the coil.
- To study the zener diode in terms of voltage regulation.
- Study of a RC Transmission line at 60 Hz.
- Study of a LC transmission line
  - a fixed frequency (ii) at variable frequency
- Study the characteristics of a field effect transistor (FET) and design and study of amplifier of finite gain.
- Study of magnetic field due to a current
- Measurement of low resistance by Carey-Foster Bridge.
- Measurement of inductance using impedance at different frequencies.
- Measurement of capacitance using impedance at different frequencies.
- Study of decay of currents in LR and RC circuits.
- Response curve for LCR circuit and resonance frequency and quality factor.
- To determine the frequency of A.C mains

**Suggested Readings:**


- Basic Electronics: A text lab manual, P.B.Zbar, A.P.Malvino, M.A.Miller, 1994, Mc-Graw Hill.
- OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall.
- Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.
- Electronic Devices & circuit Theory, R.L.Boylestad&L.D.Nashelsky, 2009, Pearson
- A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11th Edn, 2011,Kitab Mahal
- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House


## DCZO-301: Biology of Chordates

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** After successfully completing the course, the students will be able to:

- Develop an understanding of the evolution of vertebrates thus integrating structure, function and development.
- Have an overview of the evolutionary concepts including homology and homoplasy, and detailed discussions of major organ systems.
- Know and appreciate how cells, tissues, and organisms function at different levels

**UNIT-I**

a) An outline classification of chordates up to orders but up to subclasses only in case of proto-chordate groups and mammals.
b) Comparative anatomy of vertebrates from an evolutionary point of view of the following:-
    a. Integument including structure and development of placoid scales, feathers and hair.
    b. Heart and aortic arches.
    c. Kidney and associated urinogenital ducts
c) Habit and habitat, reproduction (excluding development) and affinities to following types:-
d) Hemichordate: *Banlanoglossus*
e) Urocohordata: *Herdmania,* ascidians tadpole larva and its metamorphosis.
f) Cephalochordata: *Amphioxus*

**UNIT-II**

Habit, habitat, of the following types:

a) Agnatha: Petromyzon (affinities with other vertebrate groups), affinities of Cyclostomates.
b) Pisces: *Scoliodon* (Digestive system, respiratory system, blood vascular system, urinogenital system, nervous system (central and peripheral) including sense organ)
c) Scales and fins of fishes.

**UNIT-III**

Habit, habitat, structure (morphology, digestive system, respiratory system, blood vascular system, nervous system and urinogenital system of the following types:

a) Amphibia *: Hoplobatrachus tigerinus*
b) Reptilia*: Sara hardwickii*
c) Venomous and non-venomous snakes, poison apparatus and biting mechanism. First aid of snake bite.
d) Parental care in Amphibia.

**UNIT-IV**

Habit, habitat, structure, morophology, digestive system, respiratory system, blood vascular system, nervous system and urinogenital system of the following types:-

a) Aves: *Columba*
b) Mammalia: *Rabbit*.
c) Origin of birds, migration & flight adaptation of birds.

**Practical:**

**1.** Study of Museum specimen with respect to levels and patterns of organization, biosystematics, biodiversity, adaptations, development stages, population dynamics, ecological implications etc.
    j. **Hemichordata**: *Balanoglossus.*
    k. **Urochordata**: *Herdmania, Pyrosoma.*
    l. **Cephalochordata**: *Amphioxus.*
    m. **Cyclostomata**: *Petromyzon, Myxine.*
    n. **Pisces**: *Scoliodon, Sphyrna, Torpedo, Pristis, Trygon, Lepidosteus, Clarias, Ophiocephalus, Anabas, Exocoetus, Hippocampus, Tetradon, Protopterus.*

o. **Amphibia:** *Icthyophis, Necturus, Proteus, Ambystoma, Axolotl larva, Triturus. Amphiuma, Alytes, Bufo.*
p. **Reptilia:** *Testudo, Trionyx, Sphenodon, Hemidactylus, Draco, Calotes, Chamaeleon, Varanus, Heloderma, Typhlops, Eryx, Hydrophis, Viper, Bungarus, Naja, Alligator;* Identification of Venomous and Non-venomous Snakes.
q. **Aves:** *Pavo, Columba, Psitacula, Passer, Corvus, Archaeopteryx.*
r. **Mammals:** *Ornithorhynchus, Echidna, Macropus, Loris, Manis, Rattus*.

2. **Study of Permanent Slides:**
   **d.** ***Balanoglossus****:* T.S. of proboscis, collar region and trunk
   **e.** ***Amphioxus****:* T.S. or oral hood, pharynx
   **f.** **Mammals**: T.S. of skin, stomach, duodenum, ileum, liver, Pancreas, spleen, lungs, kidney, Testis, Ovary.
3. **Osteology:**
   **d.** Study of skull bone of Frog, *Varanus*, Bird and Rabbit.
   **e.** Study of vertebral of Frog. *Varanus*, Bird and Rabbit.
   **f.** Study of girdles, forelimb and hind limb bones of Frog, *Varanus*, Bird and Rabbit.
4. Dissections and / or its demonstration through Charts / Models / Video / CD / digital alternatives etc and / or preparation of working models of the different system of the following animals.
   c. ***Scoliodon****:* Afferent branchial systems, efferent branchial system, cranial nerves and internal ear.
   d. **Frog**: Digestive, system, Urino-genital system
5. **Permanent /Temporary preparation of the following-:**
   **e.** Scales: Placoid, Cycloid
   **f.** Blood film of any vertebrate
   **g.** Filoplumes of birds
   **h.** Thigh muscles of frog
6. **Microtomy**: Fixing, block making, section cutting, staining, mounting and submission of slides.

**Note:**

- Use of animals for dissection is subject to the conditions that these are not banned under the Wildlife Protection Act or any other legislation
- Students are required to submit the following during examination.
- One assignment on the instrument/ technique about its principle, working, precautions and applications; and /or reagents / solutions preparation.
- Report on study of animals from their natural habitat from their local surroundings. Live Zoology Project Report.

**Suggested Readings:**


- Modern Textbook of Zoology: Vertebrate by R.L. Kotpal – Rastogi Publication, Merrut, 3rd Edition,2008
- A Textbook of Zoology Vol. II by Parkar and Hasswel – (MacMillan)
- A Textbook of Zoology Vol. II by R.D. Vidyarthi – (S. Chand & Co. Delhi)
- Life of Vertebrates by J. Z. Young – (Oxford University Press)
- The Vertebrates by A.S. Romer – (vakils, Ferrer& Simons, Bombay)
- Elements of Chordate Anatomy by Weichert – (McGraw Hill)
- The Birds by R.L. Kotpal (4th Edition) – Rastogi Publications, 2008
- Bird Migration by D.R. Griffin – (Doubleday, Garden city, USA)
- The Book of Indian birds by salim Ali.
- Fish and Fisheries by K. Pandey and J.P. Shukla (2nd Edition) (Rastogi Publication, 2008)
- Indian Fishes by Qureshi – (Brij Brothers., Bhopal)
- Comparative anatomy of the vertebrates by George C Kent- 3rd Saint Louis: The C.V. Mosby Co 1973
- Animal taxonomy and evolution, Dr VS Pawar, Hindi Edition, College book centre, Chaura Rasta Jaipur

**EDPC-301: General Pedagogoy: Basic of Pedagogy at Secondary Stage**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

This course deals with diverse range of topics of basics of pedagogy at secondary sage that will equip student teachers with valuable knowledge, capacities and competencies. This course comprises four units and a practicum. This course prepares student teachers to understand secondary-stage learners and design teaching accordingly. This course also aims to equip teachers with the necessary tools, knowledge, and competencies to continuously evolve as professionals and create a positive and transformative impact on their students and society as a whole. In this course a strong foundation will be established by exploring the fundamental principles and concepts that support basics of pedagogy in the light aims and objectives of the curriculum. This course emphasizes understanding learners and their backgrounds comprehensively so that an engaging and supportive learning environment, that fosters a need for learning, can be created for facilitating learner's holistic development. This course is designed to equip student teachers with a wide array of teaching learning strategies. It also focuses on innovative and transformative approaches to education, aiming to create lifelong learners equipped to thrive in an ever-changing world. Through professional development opportunities, student teachers will be better prepared to meet the ever-changing demands of the educational landscape and inspire the next generation of learners.

**Course Learning Outcomes**

After completion of this course, student teachers will be able to:

- build comprehensive understanding of secondary stage learners,
- assess the physical, mental, social, and emotional growth of secondary stage learners,
- develop skills to observe and recognize the unique capabilities and strengths of secondary stage learner,
- discuss the necessary knowledge and skills to implement effective teaching and learning strategies,
- create enriching and inclusive learning environments to foster values-based education,
- develop a deeper understanding of various pedagogical approaches and their impact on learners,
- determine the knowledge to make informed decisions about instructional practices,

- explain the crucial role of pedagogy in facilitating effective learning experiences for students,
- outline knowledge and skills necessary for continuous professional development.

**UNIT – I**

Understanding Secondary Stage Learners

A. Understanding the learners and learner background
   i. The physical, mental, social, and emotional growth of learners
   ii. Thought processes and cognitive skills of learners.
   iii. Psychological and social orientations of learners
   iv. Social and academic lives of learners
   v. Conflicts and challenges of secondary learners
   vi. Characteristics of secondary stage learners
B. Observing the unique capabilities of a child

**UNIT – II**

Strategies of Teaching and Learning

A. Understanding teaching and learning strategies:
   i. Concept, characteristics and functions of teaching
   ii. Making abstract concepts enjoyable by relating them to real-life situations,
   iii. Promoting multidisciplinary learning through integration of different disciplines
   iv. Promoting learner participation and engagement in learning
   v. Building values through art integrated activities, community engagement etc.
   vi. Promoting multidisciplinary learning through integration of different disciplines
   vii. Promoting health and social sensitivities
   viii. Developing respect toward cultural heritage
   ix. Making classrooms inclusive and joyful learning spaces
B. Relationship between Aims and Values of Education, Curriculum and Pedagogy

**UNIT - III**

Pedagogical Approaches

a) Pedagogical approaches: constructivist approach; collaborative approach; reflective approach; integrative approach, inquiry- based approach; other contemporary approaches, art-integrated learning, sports-integrated learning.
b) Types of pedagogy: social pedagogy; critical pedagogy; culturally responsive pedagogy; Socratic pedagogy in inclusive setup.
c) Role of pedagogy in effective learning: how does pedagogy impact the learner?

**UNIT – IV**

Cntinuous Professional Development of Teacher

a) Meaning and need, professional and ethical competencies and need for updating content and pedagogical competencies to develop their professional competencies.
b) Professional development activities: seminars, conferences, orientation programmes, workshops, online and offline courses, competitions, publications, development of teaching portfolio, capacity building programmes, and teacher exchange programmes.
c) Development of professional competencies to deal with gender issues, equity and inclusion, ethical issues, environmental issues, human health and well-being, population, human rights, and various issues (emotional, mental, physical issues related to pandemic (for example covid-19).

**Suggestive Practicum (Best out of Two**)

- Analyze NEP 2020 with reference to pedagogical aspects of the concerned subject.
- Analyze and reflect on the qualities of an 'Innovative Teacher' in Context of National Professional Standards for Teachers (NPST) and National Mentoring Mission (NMM).
- Explore different platforms such as National Teacher's Portal, NISHTHA, DIKSHA, and SWAYAM for an online course and prepare a report.

- Participate in a workshop or seminar to explore the concept of Continuous Professional Development (CPD), its significance in lifelong learning and prepare a write up on the findings.
- Develop teaching learning strategies to address the needs of diverse learners in context of gender, equity and inclusion and prepare a PowerPoint presentation.
- Raise awareness on the ethical and social challenges in education through field trip and create an e-portfolio.
- Any other project assigned by HEI.

**Suggestive Mode of Transaction**

Lecture cum discussion, project-based method, problem solving method, experiential learning, art integrated learning, sports integrated learning, ICT integrated learning, interactive methods such as group discussions, peer tutoring, workshops, observations, and presentations.

**Suggestive Mode of Assessment**

Portfolio creation, written tests, classroom presentations, seminars, assignments, practicum, sessional, terminal semester examinations (As per UGC norms)

**Suggestive Reading Materials**

- National Council of Educational Research and Training. (April 2022). Mandate documents Guidelines for the development of National Curriculum Frameworks.
- National Education Policy 2020, MoE, Government of India (English and Hindi)
- National Steering Committee for National Curriculum Frameworks, (2023). Draft
- National Curriculum Framework for School Education.
- National Policy on Education 1968, 1986 and 2020.

Teachers may also suggest books/readings as per the need of the learners and learning content.

# SEMESTER IV

**EDFE-401: Philosophical & Sociological Perspective of Education-I**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

The course aims at enabling student teachers to explore educational philosophy, including the concept, nature and scope; the aims of educational philosophy; relationship between philosophy and education; Indian philosophical traditions and their implications for education; some of the key philosophical schools of thought such as idealism, naturalism, pragmatism, progressivism and existentialism and their implication for educational practices. The course also would provide an analysis of the Western schools of philosophy and their approaches etc.

**Course Learning Outcomes**

- To encourage students to explore the nature of knowledge, the nature of human beings, the nature of society and its aims and the educational implications of these understandings.
- To engage the prospective teachers to read and acquaint themselves with the meaning of terms like Vidya, Avidya, Shiksha, Education etc. and to facilitate them to understand and differentiate them through reflections on these terms on the basis of ancient Indian texts.
- To facilitate prospective teachers to engage themselves in peer groups for sharing of their real-life reflective experiences regarding socio-cultural and philosophical living and facilitate them to conceptualize the meaning of terms like philosophical, social and cultural traditions in Indian educational context.
- To orient and engage prospective teachers to read, observe and understand the vision of some great Indian and global educators and categorically reflect on vision/aim, process of education and the contemporary relevance.

**UNIT – I**

Education and Philosophy

a) Conceptual clarity, nature and relationships.
b) Aims of studying philosophical perspective of education.

c) Branches of Philosophy and their educational implications: Metaphysics (तत्त् मीमांसा), Epistemology (ज्ञान मीमांसा), Axiology (मूल्य मीमांसा)
d) Understanding Indian Perspective of Education

**UNIT – II**

a) Meaning, nature and aims of education with special reference to Vedic, Buddhist, Jain, Sikh and Islamic traditions.
b) Understanding the terms Darshana, Para and Apara Vidya, Avidya, Shiksha, Samvaad, Panchkosha, Gurukulam, Acharya, Guru, Shishya, Upadhyaya, Jigyasa, Swadhyaya.
c) Understanding Western Perspective of Education
d) Meaning, Nature and aims of education with reference to Cognitive, Behaviorist and Developmental theories of Education.

**UNIT – III**

Philosophical Schools and Education

a) Conceptual Clarity of the following schools of thoughts with their implications for educational practices:
b) Bharatiya: Samakhya, Yoga, Nyaya, Vaisheshika, Mimansa, Vedanta
c) Western: Idealism, Naturalism, Pragmatism, Progressivism.

Educational Thinkers

a) Deliberations on aims, process and educational institutions developed on thoughts of following thinkers and practitioners:
b) Bharatiya: Swami Vivekananda, Sri Aurobindo Ghosh, J. Krishnamurti, Mahamana Madan Mohan Malaviya.
c) Western: J. Rousse, Maria Montessori, Friedrich Froebel, John Dewey.

**UNIT - IV**

Value Education

a) Conceptual Clarity, Significance and Types of Values.
b) Indian Traditional Values.
c) Guru-Shishya-Parampara and Educational Values.
d) Convocation message in Taittiriya Upanishad.
e) Values enshrined in Indian Constitution.
f) NEP, 2020 and Values with special reference to 21st Century.
g) Pedagogical Issues.

**Suggestive Practicum**

- Individual/group assignments/tasks in various forms like writing small paragraphs/brief notes, conceptualizations on specific terms etc.
- Institutional visits in small groups in coordination to institutions related to different thinker/s and preparation of a report followed by individual/group presentation.
- Sharing of student experiences (in groups) related to readings on great thinkers help to reshape their concept and enable them to develop vision, mission and objectives for a school and their plan to accomplish the objectives in form of a group report.
- Identification and reporting of Indian perspective related to educational aims, student-teacher characteristics, methods, evaluation procedure, convocation etc. based on critical study of life and thoughts of thinkers.

**Suggestive Mode of Transaction**

The course content transaction will include the following:

- Organized lectures using variety of media.
- Small group discussion, panel interactions, small theme based seminars, group discussions, cooperative teaching and team teaching, engagement of in reading of primary or secondary sources of literature (Original texts, reference books etc.) related to different aspects of life and education of Great Educators, case studies, short term project work etc.

- Critically examining their experiences to carve out their world and life view and further analyze them from philosophical point of view to reshape their perspective. They will engage prospective teachers in the development of comparative educational charts related to vision, aims, process, institution etc. They will also lead to reading-based interactions and critical reflections related to process and significance of entry/admission rituals, convocation system etc.

**Suggestive Mode of Assessment**
The assessment will be based on the tests and assignments.

**Suggestive Reading Materials**
Teachers may suggest books/readings as per the need of the learners and learning content

**DCBO-401: Biosystematics and Anatomy**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –

1. Know the fundamental principles of Angiosperm taxonomy, fundamental concepts of artificial, natural and phylogenetic system of classification
2. Classify the Bentham & Hooker, Engler & Prantle and Hutchinson, system of classification.
3. Process of Herbarium; Tools and techniques
4. Know the Botanical Nomenclature: Principles and rules of ICBN
5. Explain different types of Plant tissues
6. Diffrenciate the anatomy of root, stem leaves
7. Apply the knowledge of tissue system to differentiate monocot and dicot root, stem and leaves

**UNIT-I**

Angiosperms: Origin and evolution; primitive angiosperms. Diversity in plant forms-annuals, biennials and perennials; convergence of evolution of tree habit in monocotyledons and di-cotyledons, trees-largest and longest lived seed plants.

**UNIT-II**

Botanical Nomenclature: Principles and rules of ICBN, type of concept, taxonomical categories, principle of priority, identification keys, floras.

Herbarium; Tools and techniques, important herbaria and botanical gardens of India and their importance.

**UNIT- III**

**Flower:** A modified shoot; development, structure and function of anther and pistil; Development of male and female gametophytes; Types of pollination; attractions and rewards for pollinators.

**Fertilization:** Double fertilization, Apomixis, Parthenocarpy

**Embryo:** Embryo development in Dicots and monocots; Polyembryony.

**Endosperm:** Types, development, structure and functions of endosperm, haustorial and ruminate endosperm.

**Fruits:** Development and types of fruits.

**UNIT- IV**

The basic body plan of a flowering plant; Types of Tissue and Tissue System.

**The shoot system:** The shoot apical meristems and its histological organization; vascularization of primary shoot in monocotyledons and dicotyledons; cambium and its functions; formation of secondary xylem; a general account of wood; characteristics of growth rings, sapwood and heart wood; secondary phloem – structure – function relationships; periderm

**Leaf:** Origin, development, arrangement and internal structure; adaptations to water stress

**The root system:** The root apical meristem and its organisation; differentiation of primary and secondary tissues and their roles; structural modifications for storage, respiration, reproduction and for interaction with microbes.

**Suggested Readings**


- Davis, P.H. and Heywood, V.H. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd, London.
- Heywood, V.H. and Moore, D.M. (eds) 1984. Current Concepts in Plant Taxonomy. Academic Press. London. 62 Jaffrey, C, 1982. an Introduction to Plant Taxonomy, Cambridge University Press, Cambridge, London.
- Jones, S.B., Jr. and Luchsinger, A.E. 1986. Plant Systematics (2nd edition). Mc Graw-Hill Book Co., New York.
- Maheshwari, J.K. 1963. Flora of Delhi, CSIR, New Delhi.
- Radrord, A.E. 1986. Fundamentals of Plant Systematics. Harper and Row, New York.
- Singh, F. 1999. Plant Systematics: theory and Practice. Oxford and IBH Pvt. Ltd., New Delhi.
- State, C.A. 1989. Plant Taxonomy and Biosystematics (2nd edition). Edward Arnold, London


**DCBO-402: Biosystematics and Embryology**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.

- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –

- Recognize the technical terms used in plant identification.
- Distinguish the Diversity of flowering plants families, different parts of the plants for human welfare.
- Apply the Concept of plant identification in the fields
- Know the parts of flower and their significance
- Process of the interaction between pollen and pistil during pollination.
- Explain different types of embryo development and different types of endosperms

**UNIT-I**

Angiosperm taxonomy: Brief history, aims and fundamental concepts of artificial, natural and phylogenetic system of classification, Bentham & Hooker, Engler & Prantle and Hutchinson, system of classification.
Modern system of Classification

**UNIT-II**

Diversity of Flowering plants as illustrated by members of the families – Brassicaceae, Malvaceae, Rutaceae, Papillionaceae, Caesalpinaceae, Mimosaceae, Cucurbitaceae, Apiaceae, Asteraceae

**UNIT-III**

Diversity of flowering plants as illustrated by members of the families –Apocynaceae, Asclepiadaceae, Solanaceae, Acanthaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Liliaceae, Poaceae.

**UNIT-IV**

Economic Botany: - Origin, Cultivation and value added products of following:
Cereals: Rice, Wheat and Maize
Milletes: Pearl Millet/Bajra, Finger Millet/Ragi, Foxtail Millet, Jowar (Sorghum)
Vegetables and fruits:onion, radish, garlic, banana, apple, guava
Oil Yielding Plants: Mustard, Groundnut and Coconut
Fibre Yielding Plants: Cotton, Sun-hemp
Spices : Cardamom, Fennel, Cumin, Coriander
Medicinal plants : Opium, Cinchona, Sarpagandha.
Beverages : Tea & Coffee
Rubber : General Account

**Suggested Readings**


- Davis, P.H. and Heywood, V.H. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd, London.

- Heywood, V.H. and Moore, D.M. (eds) 1984. Current Concepts in Plant Taxonomy. Academic Press. London. 62 Jaffrey, C, 1982. An Introduction to Plant Taxonomy, Cambridge University Press, Cambridge, London.
- Jones, S.B., Jr. and Luchsinger, A.E. 1986. Plant Systematics (2nd edition). Mc Graw-Hill Book Co., New York.
- Maheshwari, J.K. 1963. Flora of Delhi, CSIR, New Delhi.
- Radrord, A.E. 1986. Fundamentals of Plant Systematics. Harper and Row, New York.
- Singh, F. 1999. Plant Systematics: theory and Practice. Oxford and IBH Pvt. Ltd., New Delhi.
- State, C.A. 1989. Plant Taxonomy and Biosystematics (2nd edition). Edward Arnold, London Snustad, D.P. and Simmons, M. J. 2000. Principles of Genetics. John Wiley & Sons, Inc., USA.


**Practicals**

- Familiarity with the terms used in technical description of plants.
- Study of representative plants of families included in the syllabus.
- Field visit for identification and collection of plants/ reputed Indian institute of botany
- Anatomy of primary and secondary growth in monocots and dicots using hand sections (or prepared slides). Structure of secondary phloem and xylem. Growth rings in wood. Microscopic study of wood in T.S., T.L.S. and R.L.S. Anomalous Sec. growth in *Boerhaavia, Nyctanthus* and *Dracaena*
- Anatomy of leaf and Peel mount for stomatal types/trichomes.
- Anatomy of the root. Primary and secondary structure.
- Examination of a wide range of flowers available in the locality and methods of their pollination.
- Structure of anther, microsporogenesis (using slides) and pollen grains (using whole mounts). Pollen viability using *in vitro* pollen germination.
- Structure of ovule and embryo sac development (using serial sections).

## DCCH-401: General Chemistry-III

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)

C2: As per class schedule –Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes:** By the end of this course, students will be able to:

- Derive mathematical expressions for different properties of gases and liquids and understand their physical significance.
- Chemistry of inner transition elements (Lanthanide and Actinides).
- Reflet the concepts of stereochemistry and its role in determining the three-dimensional arrangement of molecules.
- Idenify and apply the General concepts, principles, kinetics and methodology of polymers.
- Perform and demonstrate 145ehavio concepts involved in quantitative analysis and Organic synthesis.

**UNIT – I**

**Gaseous and Liquid State:**

Gaseous State- Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation, collision frequency, collision diameter, mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity, calculation of $\sigma$ from $\eta$, variation of viscosity with temperature and pressure, Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities, Behaviour of real gases: Deviations from ideal gas 145ehavior, compressibility factor, Z, and its variation with pressure for different gases, Causes of deviation from ideal 145ehavior, Van der Waals equation of state, its derivation and application in explaining real gas 145ehavior, mention of other equations of state (Berthelot, Dietrici), virial equation of state, van der Waals equation expressed in virial form and calculation of Boyle temperature, Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, relation between critical constants, van der Waals constants and law of corresponding states

Liquid state- Qualitative treatment of the structure of the liquid state, Radial distribution function, physical properties of liquids, vapour pressure, surface tension and coefficient of viscosity, and their determination, Effect of addition of various solutes on surface tension and viscosity, Explanation of cleansing action of detergents, Temperature variation of viscosity of liquids and comparison with that of gases, and Qualitative discussion of structure of water.

**UNIT – II**

**Chemistry of Lanthanide and Actinide:** Chemistry of Lanthanides: occurrence and separation, Electronic configuration, oxidation states, colour, spectral and magnetic properties, lanthanide contraction, complex formation and applications,

Chemistry of Actinides: Electronic configuration, oxidation states, colour, spectral and magnetic properties, actinide contraction, complex formation and applications, chemistry of separation of Np, Pu and Am from Uranium, similarities between the later actinides and lanthanides.

**UNIT – III**

**Stereochemistry:**

Concept of isomerism, Types of isomerism; Optical isomerism – elements of symmetry, molecular chirality, enantiomers, stereogenic center, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemisation, Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature, Geometric isomerism – determination of configuration of geometric isomers, E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds, Conformational isomerism – conformational analysis of ethane and n-butane, conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives, Newman projection and Sawhorse formulae, Fischer and flying wedge formula, Difference between configuration and conformation.

**UNIT – IV**

**Macromolecules and Surface Chemistry:**

Macromolecules – Nomenclature, classification, properties of polymer, mass of macromolecules, number average and weight average molecular mass, determination of molecular weight by osmotic pressure, viscosity and light scattering and sedimentation methods.
Surface Chemistry- Sorption at surfaces, physical and chemical adsorption, factors affecting adsorption, Freundlich, Langmuir and Gibbs adsorption isotherms and their derivation, estimation of surface area (BET equation), Streaming potential electrophoresis and elctrosmosis.

**Suggested Readings:**


- Atkins, P.W.; Paula, J.de. (2014), Atkin's Physical Chemistry Ed., 10th Edition, Oxford
- Principles of Physical Chemistry, B.R. Puri & L.R. Sharma, Shoban Lal Nagin Chand & Co.
- Castellan, G. W. (2004), Physical Chemistry, 4th Edition, Narosa.
- Kapoor, K.L. (2015), A Textbook of Physical Chemistry, Vol 1, 6th Edition, McGraw Hill Education.
- Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
- Cotton, F.A., Wilkinson, G. &Gaus, P.L. *Basic Inorganic Chemistry*, 3rd ed., Wiley.
- Douglas, B.E., McDaniel, D.H. & Alexander, J.J. *Concepts and Models in Inorganic Chemistry*, John Wiley & Sons.
- Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. *Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson Education India, 2006.
- Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, Orient Longman, New Delhi (1988).
- 12. Eliel, E.L. *Stereochemistry of Carbon Compounds*, Tata McGraw Hill education, 2000.
- 13. Eliel, E.L., Wilen, S.H. (1994), Stereochemistry of Organic Compounds; Wiley: London.
- 14. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education)..
- 15. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005.
- Barrow, G.M. *Physical Chemistry* Tata McGraw-Hill (2007).
- Physical Chemistry by S. Glasston, Third Edition, D.Van Nostrand Company, Inc.
- Micelles: Theoretical and applied aspects YoshikiyoMoroi, Springer Publications.
- Physical Chemistry, Puri Sharma and Pathania, Vishal Publication.
- Physical Chemistry, Beli & Tuli, S. chand Publication, Delhi.
- Introduction to Polymer Science, V.R. Gawariker, N.V. Vishwanathan & J. Shridhar, Wiley Eastern.


**Practical-IV Minor**

**Credit of the Course:** 1
**Syllabus:**

1. **Quantitative Analysis: Volumetric Analysis**
   a) Quantitative estimation of one metal volumetrically from a given mixture.
   b) To estimate magnesium volumetrically from a mixture containing $Ba^{2+}$ and $Mg^{2+}$ Ions/ $Zn^{2+}$ and $Mg^{2+}$ ions.
   c) To estimate copper iodometrically from a given mixture containing $Pb^{2+}$ and $Cu^{2+}$ ions.
   d) Estimation of Glucose with the help of Fehling's solution.
   e) Determination of Total hardness of water.
2. **Synthesis of Inorganic complexes and organic compounds Inorganic Complexes.**
   a) Preparation of sodium trisoxalato ferrate (III)
   b) preparation of Tetraamine copper (II) sulpahte
3. **Organic Synthesis (One Step)**
   a) Acetylation of salicylic acid, aniline,
   b) Aliphatic electrophilic substitution: Preparation of iodoform from ethanol and acetone.
4. **Viva-Voce**
5. **Evaluation of record book of experiments performed in semester.**

**DCCH-402: Organic Chemistry-II**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |

| | |
|---|---|
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8$^{th}$ week)
C2: As per class schedule –Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15$^{th}$ Week).

**Course Learning Outcomes:** By the end of this course, students will be able to –

1. Reflect upon various concepts of Nitrogen containing compounds
2. Identify various aspects of Heterocyclic compounds.
3. Reflect upon concepts of nucleic acids, amino acids and peptides, proteins for living systems.
4. Reflect upon chemistry of carbohydrates and Lipids.
5. Perform and devlop skills involved in syhtesis of Inroganic and Organic compounds.
6. Perform and demonstrate the concepts involved in various experiments of Photchemistry.

## UNIT-I

**Nitrogen Containing Functional Groups**

Preparation and important reactions of nitroarenes, reactivity of nitro substituted arenes, Aromatic amines: classification, preparation, Effect of substituent and solvent on basicity; Preparation and properties of 1°, 2° and 3°amines Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction, Hofmann- elimination reaction; Distinction between 1°, 2° and 3°amines with Hinsberg reagent and nitrous acid, Diazonium Salts: Preparation and their synthetic applications, Diazo coupling and its mechanism.

## UNIT-II

**Heterocyclic Compounds**

Classification and nomenclature, Structure, Aromaticity in 5-numbered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis and Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Pyrimidine,

Introduction to condensed five and six memebered heterocyles, preparation and reaction of indole, quinoline and isoquinoline with special reference to Fischer indole synthesis, Skraup's synthesis, Knorr quinoline synthesis, Doebner-Miller synthesis, Bischler-Napieralski synthesis, Pictet-Spengler reaction, Pomeranz-Fritsch reaction.

Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

## UNIT-III

**Amino Acids, Peptides, Proteins & Enzymes:**

Amino acids, Peptides and their classification- α-Amino Acids – Synthesis, ionic properties and reactions, Zwitterions, pKa values, isoelectric point and electrophoresis

Study of peptides: determination of their primary structures-end group analysis, methods of peptide synthesis, Synthesis of peptides using N-protecting, C-protecting and C-activating groups –Solid-phase synthesis

Enzymes- Introduction, classification and characteristics of enzymes, Salient features of active site of enzymes, Mechanism of enzyme action (taking trypsin as example), factors affecting enzyme action, coenzymes and cofactors and their role in biological reactions, specificity of enzyme action (including stereospecificity), enzyme inhibitors and their importance, phenomenon of inhibition (competitive, uncompetitive and non-competitive inhibition including allosteric inhibition).

## UNIT-IV

**Carbohydrates and Lipids:**

Carbohydrate- Occurrence, classification and their biological importance, Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures, Interconversions of aldoses and ketoses, Killiani-Fischer synthesis and Ruff degradation, Disaccharides – Structure elucidation of maltose, lactose and sucrose, Polysaccharides – Elementary treatment of starch, cellulose and glycogen.

Lipids- Introduction to oils and fats, common fatty acids present in oils and fats, Hydrogenation of fats and oils, Saponification value, acid value, iodine number, Reversion and rancidity.

**Suggested Readings:**


- Finar, I. L. Organic Chemistry (Volume 1& ll), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Acheson, R.M. Introduction to the Chemistry of Heterocyclic compounds, John Wiley & Sons (1976).
- Graham Solomons, T.W. Organic Chemistry, John Wiley & Sons, Inc


## Practical-IV Major

**Credit of the Course**: **2**

**Syllabus:**

1. **Synthesis of Inorganic complexes and organic compounds Inorganic Complexes.**
    a) Preparation of sodium trisoxalato ferrate (III)
    b) Preparation of Ni-DMG complex.
    c) Preparation of cis-and trans-bisoxalatodiaquo chromate (III) ion.
    d) Cuprous chloride
    e) Sodium thiosulphate
    f) Ferrous sulphate from Kipp's waste
    g) Mercury tetrathiocyanate
2. **Organic Synthesis**
    a) Acetylation of salicylic acid, aniline, glucose and hydroquinone, benzoylation of aniline and phenol.
    b) Aliphatic electrophilic substitution: Preparation of iodoform from ethanol and acetone.
    c) Aromatic electrophillicsubstitution-
        I. Preparation of m-dinitrobenzene from nitrobenzene.
        II. Preparation of p-nitroacetanilide from acetanilide.
        III. Preparation of p-bromoaccetanilide from acetanilide.
        IV. Preparation of 2,4,6-tribromophenol from phenol.
    d) Diazotization/coupling – Preparation of methyl orange and methyl red.
    e) Oxidation: Preparation of benzoic acid from toluene
    f) Reduction: Preparation of aniline from nitrobenezene.
3. **Polarimetry**
    a) Determination of the specific rotation of a given optically active compound and determination of the concentration of given solution of an optically active substance.

4. **Viva-Voce**
5. **Evaluation of record book of experiments performed in semester.**

**DCMA-401: Partial Differential Equation**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of $8^{th}$ week)
C2: As per class schedule –Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of $15^{th}$ Week).

**Partial Differential Equation (Minor/Major)**

Course Learning Outcomes: After completion of this course the student will be able to:

- Formulate and classify the partial differential equations.
- ii) Solve linear and non-linear partial differential equations using various methods; and
- apply these methods in solving physical problems.

**UNIT-I**

Linear partial differential equations of the first order, Lagrange's method, Non-linear partial differential equations of the first order, Charpit's method for solution.

**UNIT-II**

Homogeneous and non- homogeneous partial differential equations with constant coefficients, partial differential equations reducible to equations with constant coefficients, Monge's method.

**UNIT- III**

Classification of second order partial differential equations, reduction to canonical form.

**UNIT-IV**

Method of separation of variables for second order PDE, Existence and uniqueness of solution of vibrating string problem, Heat conduction problem, Existence and uniqueness of solution of heat conduction problem.

**Recommended Readings:**

- Ordinary and Partial Differential Equations, M. D. Raisinghania and R. S. Aggarwal, S. Chand & Company, New Delhi, 2ndedition 1983.
- Theory and problems of Differential equations, Frank Ayres, McGraw-Hill Book Company, Singapore, 1stedition 1972.

**DCMA-402: Liner Algebra-I**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8$^{th}$ week)
C2: As per class schedule –Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15$^{th}$ Week).

**Linear Algebra-I**

**Course Learning Outcomes:** After completion of this course the student will be able to:

- The concept of linear independence of vectors over a field, the idea of a finite dimensional vector space, basis of a vector space and the dimension of a vector space.
- Basic concepts of linear transformations, the Rank-Nullity Theorem, matrix of a linear transformation, algebra of transformations and the change of basis.
- Apply Cayley-Hamilton theorem, Diagonalization and compute Eigen values and Eigen Vectors.

**UNIT-I**

Algebra of matrices, Properties of determinants, System of linear equations: Equivalent systems, Elementary row operations, Row-reduced echelon matrices, Block matrices.

**UNIT-II**

Introduction of Vector Spaces: Vector spaces, Subspaces, Algebra of subspaces, Quotient spaces, Linear combination of vectors, Linear span, Linear dependence and independence, Basis and dimension, Dimension of subspaces.

**UNIT-III**

Linear transformations: Null space, Range, Rank and nullity of a linear transformation, Matrix representation of a linear transformation, Algebra of linear transformations. Isomorphisms, Isomorphism theorems, Invertibility and the change of coordinate matrix.

**UNIT-IV**

Diagonalization: Polynomial of matrices, Characterstic polynomial, Cayley-Hamilton theorem, Diagonalization, Eigen values and Eigen Vectors, Diagonalizing Real Symmetric Matrices, Minimal Polynomials, Characteristic and Minimal polynomials of Block matrices.

**Recommended Readings:**


- Friedberg, Stephen H., Insel, Arnold J., & Spence, Lawrence E. (2003). Linear Algebra (4th ed.). Prentice-Hall of India Pvt. Ltd. New Delhi.
- Hoffmann K. and Kunze R., 1992, Linear Algebra, Prentice Hall of India.
- Strang, G. Linear Algebra and its Applications, Thomson.


## DCPY-401: Thermal Physics

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule –Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** Student teachers will be able to:

- Define the different concepts of kinetic theory of gases.
- Explain the different concepts of kinetic theory of gases.
- Apply the different concepts of thermodynamics to solve the Problems.
- Define Maxwell's thermodynamic relations and apply them in different situations.
- Explain the different laws of thermodynamics.

**UNIT-I**

Ideal Gas: Kinetic theory of gases, deduction of Boyle's law, interpretation of temperature, estimation of rms speeds of molecules, Brownian motion, estimate of the Avogadro number, Equipartition of energy, specific heat of monoatomic gas, extension to diand triatomic gases, Behaviour at low temperatures, Adiabatic expansion of an ideal gas, applications to atmospheric physics.

Real Gas: Van der Waals gas, equation of state, nature of Van der Waals forces, comparison with experimental P-V curves, The critical constants, gas and vapour, Joule expansion of ideal gas and of a Vander Waals gas, Joule coefficient, Joule Thomson effect.

**UNIT-II**

Liquefaction of gases: Boyle temperature and inversion temperature, Principle of regenerative cooling and of cascade cooling, liquefaction of hydrogen and helium, Refrigeration cycles, meaning of efficiency. Transport phenomena in gases: Molecular collisions mean free path and collision cross sections, Estimates of molecular diameter and mean free path, Transport of mass, momentum and energy and interrelationship, dependence on temperature and pressure.

**UNIT-III**

The laws of thermodynamics: The Zeroth law, various indicator diagrams, work done by and on the system, first law of thermodynamics, internal energy as a state function, reversible and irreversible changes, Carnot cycle and its efficiency, Carnot theorem and the second law of thermodynamics, Different versions of the second law, practical cycles used in internal combustion engines, Entropy, principle of increase of entropy, The thermodynamic scale of temperature, its identity with the perfect gas scale, Impossibility of attaining the absolute zero temperature, third law of thermodynamics

**UNIT-IV**

Thermodynamic relationships: thermodynamic variables- extensive and intensive, Maxwell's general relationships, application to Joule – Thomson expansion and adiabatic cooling in a general system, Van der Waals gas, Clausius-Clapeyron heat equation, Thermodynamic potentials and equilibrium of thermodynamical systems, relation with thermodynamical variables, cooling due to adiabatic demagnetization, production and measurement of very low temperatures.

**Practical:**

- To determine the thermal conductivity of bad conductor by Lee's method.
- To determine the melting point of wax using platinum resistance thermometer.
- To find 'J' by Call ender and Barne's method.
- To study the temperature dependence of resistance for thermistor and find temperature coefficient of resistance and material constant.
- To study the temperature dependence of resistance of a torch bulb's filament.
- Determine the Heat capacity of a Brass.

**Suggested Readings:**

- Thermal Physics: B.K. Agarwal.
- Heat and Thermodynamics: Brij Lal and N. Subramanyam.
- Heat and Thermodynamics: Dayal, Verma and Pandey.
- A Treatise on Heat: M.N. Saha and B.N. Srivastava.
- Heat and Thermodynamics: K.W. Zemansky.
- Thermal Physics, S.C. Garg, R.M. Bansal, C.K. Ghosh.

**DCPY-402: Electrodynamics**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.

- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule –Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** Student teachers will be able to:

- Explain Maxwell's Equations and electromagnetic wave.
- Discuss Laws of Reflection, transmission at normal and oblique incidence in linear media and conducting media.
- Apply the Maxwell's Equations to solve the problems of electrodynamics.
- Explain the concepts of relativistic electrodynamics.

**UNIT-I**

Maxwell's Equations and Electromagnetic waves: Displacement current, Maxwell's Equations, Electromagnetic waves, Electromagnetic waves in an Isotropic medium, Properties of electromagnetic waves, Energy density of Electromagnetic waves, Pointing vector, Radiation pressure of free space, Electromagnetic waves in Dispersive medium, Spectrum of Electromagnetic waves.

**UNIT-II**

Electromagnetic Waves: Laws of reflection, transmission at normal and oblique incidence in linear media and conducting media (Fresnel's equations), total internal reflection and Brewster angle, Problems.

**UNIT-III**

Waveguide: Rectangular waveguides. Expressions for field components, TE, TM & TEM modes, Propagation properties, cutoff frequency, group & phase velocity, Problems.

**UNIT-IV**

Relativity and Electrodynamics: Vector and scalar potentials and Gauge transformation, Transformation relations 153eha and B, Invariance of Maxwell's equations, Motion of a charged particle under electromagnetic field.

**Suggested Readings:**


- "Electrodynamics", SatyaPrakash, PragatiPrakashan
- "Introduction to electrodynamics D.J Griffith,", Prentice Hall of India
- Principles of Electrodynamics, M. Schwartz, Dover Publications
- Jackson, Classical Electrodynamics, J.D. Wiley.
- "Optical Waveguide Theory", Snyder A and Love J, Chapmann and Hall

**DCZO-401: Ethology and Economic**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule –Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** After successfully completing the course, the students will be able to:

- Develop skills, concepts and experience to understand all aspects of animal behaviour. Objectively understand and evaluate information about animal behaviour encountered in our daily lives.
- Recognize the Economical prospective of Zoology and Animal Behaviour
- Know the Bee keeping equipments and apiary management.
- Apply and be able to objectively evaluate the role of behaviour in the protection and conservation of animals in the wild.
- evaluate 154ehavior of all animals, including humans, in the complex ecological world, including the urban environment

**UNIT-I**

a) Introduction and history of Ethology. Brief profiles of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen, Proximate and ultimate causes of behaviour, Methods and recording of a behaviour
b) Patterns of Behaviour: Stereotyped Behaviours (Orientation, Reflexes); Individual Behavioural patterns; Instinct vs. Learnt Behaviour; Associative learning, classical and operant conditioning, Habituation, Imprinting.
c) Motion: Classification of directional movements:- kinesis, tropism & taxes

**UNIT-II**

a) Communication: Definition, types of signal (touch, sound, Chemical, and visual),
b) Social Behaviour: Concept of Society; Communication and the senses; Altruism; Insects' society with Honey bee as example; Foraging in honey bee and advantages of the waggle dance.
c) Sexual Behaviour: Asymmetry of sex, Sexual dimorphism, Mate choice, Intra-sexual selection (male rivalry), Inter-sexual selection (female choice), Sexual conflict in parental care.

**UNIT-III**

a) Insects of Economic Importance: Biology, Control and damage caused by *Helicoverpa armigera*, *Pyrilla perpusilla* and *Papilio demoleus*, *Callosobruchus chinensis*, *Sitophilus oryzae* and *Tribolium castaneum*
b) Insects of Medical Importance: Medical importance and control of *Pediculus humanus corporis*, *Anopheles*, *Culex*, *Aedes*, *Xenopsylla cheopis*
c) Animal Husbandry: Preservation and artificial insemination in cattle; Induction of early puberty and synchronization of estrus in cattle
d) Poultry Farming: Principles of poultry breeding, Management of breeding stock and broilers, Processing and preservation of eggs
e) Fish Technology: Genetic improvements in aquaculture industry; Induced breeding and transportation of fish seed

**UNIT-IV**

a) Economic Importance of Invertebrates (Apiculture, Aquaculture, Sericulture).
b) Insects as pests and their management
c) Economic Importance of vertebrates (Fish culture and Poultry culture.)
d) Wild life of India, causes of depletion of wild life, modes of wild life conservation, Red data book. Environmental legislations (Wildlife Protection Act, Environment act. Biodiversity act). Wild life scenario in and around central foot hills of the Aravalli and the Thar Desert.

**Practical:**

- Demonstration of Phototactic responses by *Tribolium* / House fly / *Drosophila*.
- Demonstration of Geotactic responses by Earthworm.
- To study nests and nesting habits of the birds and social insects.
- To study the behavioural responses of wood lice to dry and humid conditions.
- Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park to study behavioural activities of animals and prepare a short report.
- Study of *Plasmodium vivax*, *Entamoeba histolytica*, *Trypanosoma gambiense*, *Ancylostoma duodenale* and *Wuchereria bancrofti* and their life stages through permanent slides/photomicrographs or specimens.
- Study of arthropod vectors associated with human diseases: *Pediculus*, *Culex*, *Anopheles*, *Aedes* and *Xenopsylla*.
- Study of insect damage to different plant parts/stored grains through damaged products/photographs.
- Identifying feature and economic importance of Helicoverpa (*Heliothis*) *armigera*, *Papilio demoleus*, *Pyrilla perpusilla*, *Callosobruchus chinensis*, *Sitophilus oryzae* and *Tribolium castaneum*
- Visit to poultry farm or animal breeding centre. Submission of visit report
- Maintenance of freshwater aquarium

**Suggested Readings:**


- Animal Ecology by S.P. Singh 6th Revised Edition – Rastogi Publications,2008
- Animal Ecology and Biostatistics. KC Soni Hindi Edition college book centre, Chaura Rasta, Jaipur
- Mammalian Endrocrinology and Animal Behavior, VS Pawar, Hindi Edition, College book centre, Chaura Rasta
- David McFarland, Animal Behaviour, Pitman Publishing Limited, London, UK.
- Manning, A. and Dawkins, M. S, An Introduction to Animal Behaviour, Cambridge, University Press, UK.
- John Alcock, Animal Behaviour, Sinauer Associate Inc., USA.
- Paul W. Sherman and John Alcock, Exploring Animal Behaviour, Sinauer Associate Inc., Massachusetts, USA.
- Chronobiology Biological Timekeeping: Jay. C. Dunlap, Jennifer. J. Loros, Patricia J. DeCoursey (ed). 2004, Sinauer Associates, Inc. Publishers, Sunderland, MA, USA
- Insect Clocks D.S. Saunders, C.G.H. Steel, X., Afopoulou (ed.) R.D. Lewis. (3rdEd) 2002 Barens and Noble Inc. New York, USA
- The Clock that times us. 1982. Moore Ed et al.
- Biological Rhythms: Vinod Kumar (2002) Narosa Publishing House, Delhi/ Springer-Verlag, Germany.

**DCZO-402: Animal Physiology and Endocrinology**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule –Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** After successfully completing the course, the students will be able to:

- Develop skills, concepts and experience to understand all aspects of animal behaviour. Objectively understand and evaluate information about animal behaviour encountered in our daily lives.
- Recognize the Economical prospective of Zoology and Animal Behaviour
- Know the Bee keeping equipments and apiary management.
- Apply and be able to objectively evaluate the role of behaviour in the protection and conservation of animals in the wild.
- evaluate 156ehavior of all animals, including humans, in the complex ecological world, including the urban environment

**UNIT-I**

a) Physiology of digestion: Chemical nature of food stuff (including micronutrients), various types of digestive enzymes and their digestive action in the alimentary canal, role of GI hormones in digestion, mechanism of absorption of digested food.
b) Physiology of respiration: Mechanism and control of breathing, exchange of gases transport of respiratory gases (oxygen and carbon dioxide)

**UNIT-II**

a) Physiology of blood circulation
b) Composition and function of blood.
c) Blood groups (ABO and Rh)
d) Blood coagulation – factors, mechanism, theories and anticoagulants.
e) Origin, conduction and regulation of heart beat in mammals.
f) Cardiac cycle, ECG

g) Nerve physiology: structure and types of neuron, origin and conduction of nerve impulse,
h) Synapse-structure, types, properties and signal transmission through synapses.

**UNIT-III**

a) Muscle physiology: Ultra-structure and mechanism of contraction of skeletal muscle, summation and fatigue.
b) Physiology of Excretion: Nitrogenous wastes, anatomy of mammalian kidney, structure of nephron, mechanism of urea and urine formation (including hormonal regulation) osmoregulation
c) Physiology of Reproduction: hormonal control of male and female reproduction, implantation, parturition and lactation in mammals
d) Female Reproductive cycle.

**UNIT-IV**

Endocrinology

a) Hormones: Classification, properties of hormones.
b) Mechanism of hormone action (peptide and steroid hormones)
c) Endocrine glands: Pituitary gland: Location, anatomy and functions of hormones with hypothalamic regulation
d) Thyroid gland: Location, anatomy, synthesis and function of T3 & T
e) Adrenal gland, Islets of Langerhans, Testes and Ovaries

**Practical:**

- Effect of temperature and pH on the salivary amylase enzyme activity.
- Preparation of Blood smears of frog / lizard/ bird / mammals.
- Identification of blood groups (ABO) and Rh factor in man.
- Estimation of Haemoglobin by Sahils method.
- Enumeration of RBC in blood samples.
- Enumeration of WBC in blood samples.
- Preparation of Haemin Crystals.
- Effect of different concentrations of NaCl on RBC.
- Measurement of blood pressure, Heart beat and Pulse rate.
- Study of bleeding time, Coagulation time of blood.
- Dissect and demonstrate the endocrine glands in rat and man (Chart or model).
- Study of Histological slides of the following endocrine gland of mammal testis, ovary, thyroid, adrenal, pituitary, Islets of Langerhans.

**Suggested Readings:**


- A text book of Medical physiology, Guyton and hall, Elsevier Pub (South Asia) 2013.
- Animal Physiology, K Schmidt – Nielson, 5$^{th}$ed, Cambridge Pub 2013.
- Biochemistry D Voet& JG Voet, Wiley 2011
- Animal Physiology by A. Maria Kutikan & N. Arumugam – (Saras Publication, Nagercoil, Tamil Nadu).
- Animal Physiology and biochemistry by K.V. Sastry – (Rastogi Publications, 2008).
- Regulatory mechanism in Vertebrates by Kamleshwar Pandey and J.P. Shukla- (Rastogi Publications, 2008)
- Animal Physiology by K.A. Goyal and K.V. Sastry –( Rastogi Publication 2008)
- Endocrinology and Reproductive Biology by K.V. Sasyry – ( Rastogi Publication 2008)
- Animal Physiology by Arora M.P. (1989) – Himalaya Publications House.
- Textbook of medical Physiology by Guyton A.C. & Hall J.E (1996) – (W.B. Saunders & Co.)
- General and Comparative Physiology by Hoar W.S. (1983) – Prentice Hall Publication)
- A textbook of Animal Physiology by Hurtkar P.C. & Mathur P.N. (1976) – S Chand & Co.
- General Endocrinology by Turner C.D. & Gangara J.T. (1971) – W.B. Saunders & Co.
- Animal Physiology , Biochemistry and Immunology, Dr KC Soni Hindi Edition , College book centre, Chaura Rasta , Jaipur

- Animal Physiology and Immunology, Dr KC Soni Hindi Edition, College book centre, Chaura Rasta, Jaipur
- Mammalian Endocrinology and Animal Behaviour , Dr VS Panwar, Hindi Edition , College book centre, Chaura Rasta, Jaipur

**DCSC-401: Nursery and Gardening Technique**

| | |
|---|---|
| Credits: 2L+0T+1P | Marks 75 |
| Contact hours per week: 5 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |
| **Total Marks** | 75 | | 30 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –

- Know the basic concepts of nursery and gardening, the objectives and scope of different types of gardening.
- Explain the role of seed and its dormancy.
- Process different techniques of vegetative propagation.

**UNIT: I**

Nursery: definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities- Planting - direct seeding and transplants.

**UNIT: II**

Seed: Structure and types - Seed dormancy; causes and methods of breaking dormancy-Seed storage Seed bunks, factors affecting seed viability, genetic erosion - Seed production technology - seed testing and certification

**UNIT: III**

Vegetative propagation: air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings - Hardening of plants- green house mist chamber. shed root, shade house and glass house

**UNIT: IV**

Gardening definition, objectives and scope different types of gardening-landscape and home gardening, parks and its components plant materials and design-computer applications in landscaping, Gardening operations soil lavine manuring watering, management

**Suggested readings:**


- Ratha Krishnan, M., et.al. (2014) Plant nursery management: Principles and practices, Central
- Arid Zone Research Institute (ICAR), Jodhpur, Rjasthan
- Kumar, N., (1997) Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
- Kumar Mishra, K., N.K. Mishra and Satish Chand (1994) Plant Propagation, John Wiley & Sons, New Jersey


**PRACTICALS**

**Course Content:**

- Demonstration of nursery bed making.
- Demonstration of preparation of media for nursery.
- Hands on training on vegetative propagation techniques.
- Hands on training on sowing methods of seeds and other material.
- Visit to an agriculture/horticulture /forest nursery.
- Case study on establishment and success of a plant nursery.

**DCSC-402: Basic Analytical Techniques**

| | |
|---|---|
| Credits: 2L+0T+1P | Marks 75 |
| Contact hours per week: 5 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |
| **Total Marks** | 75 | | 30 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes:** By the end of this course, students will be able to –

- Understand the principles and various types of chromatography, including gas chromatography, liquid chromatography, and thin-layer chromatography, and apply these techniques to separate and analyze complex mixtures.
- Explain the principles and applications of potentiometric analysis including voltammetry, cyclic voltammetry, flame photometry and its applications.

Overall, the course aims to equip students with a strong foundation in analytical techniques used in chemistry, enabling them to apply these techniques effectively in various scientific and industrial settings.

**UNIT-I**

Chromatography: principles of absorption and partition chromatography, techniques and application of column, paper and thin layer chromatography, Electrophoresis and its applications in separation of amino acids, Ion exchange methods: general discussion, action of ion exchange resins, column operation experimental techniques, Types of ion exchange resins, Determination of the following pairs by ion exchange techniques: (a) chloride and bromide (b) nickel and cobalt.

**UNIT-II**

Principle of Gravimetric analysis, precipitation methods, super saturation and precipitate formation, The purity of the precipitate, coprecipitation, post precipitation, condition of precipitation, precipitation from homogeneous solution, washing of the precipitate, ignition of the precipitate, masking and demaking agents,

Solvent extraction: principles and process of solvent extraction, the distribution law and the partition coefficient, liquid-liquid extraction, factors favouring solvent extraction, choice of solvent for solvent extraction, stripping, solid liquid extraction, organic reagents used in solvent extraction, Organic reagent in quantitative inorganic analysis, application of the following organic reagent: DMG, Cupferron, 8-hydrxyquinoline, cupron, salicylaldehyde, oxime, 1-nitroso-2-naphthol, 4-bromoandelic acid, nitron, tannic acid, arsenic acids, pyridine, anthranilic acid, pyrogallal, ethylenediamine.

**UNIT-III**

Thermal analysis: Thermo Gravimetric Analysis (TGA) and Derivative. Thermogravimetry (DTG): Principle, instrumentation and application, factor affecting TG curves, Differential Thermal Analysis (DTA): Principle, instrumentation and application and factor affecting TA curves, Differential Scanning Calorimeter (DSC): Principle, instrumentation and application, factor affecting DC curves and comparison with DTA.

**UNIT-IV**

Potentiometry: Basic principle, instrumentation, ion-selective electrodes, applications of ion-selective electrodes.

Voltammetry: Basic principle, instrumentation, classification (cyclic voltammetry, linear sweep voltammetry, and pulse voltammetry), and applications.

Flame Photometry: Basic principles, instrumentation and applications.

**Suggested Readings:**


- Christian, G.D; Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.
- Harris, D. C. Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.
- Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age, InternationalPublisher, 2009.
- Skoog, D.A. Holler F.J. &Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed.
- Mikes, O. Laboratory Hand Book of Chromatographic & Allied Methods, Elles
- Harwood Series on Analytical Chemistry, John Wiley & Sons, 1979.
- Ditts, R.V. Analytical Chemistry; Methods of Separation, van Nostrand, 1974.


**DCSC-403: Elementary Number Theory**

| | |
|---|---|
| Credits: 2L+0T+1P | Marks 75 |
| Contact hours per week: 5 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |
| **Total Marks** | 75 | | 30 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Elementary Number Theory (Skill Enhancement Course)**

**Course Learning Outcomes:** After completion of this course the student will be able to:

- Some of the open problems related to prime numbers, viz., Goldbach conjecture etc.
- About number theoretic functions and modular arithmetic.
- Public crypto systems, in particular, RSA.

**UNIT-I**

Distribution of Primes and Theory of Congruencies: Linear Diophantine equation, Prime counting function, Prime number theorem, Fermat and Mersenne primes, Congruence relation and its properties, Linear congruence and Chinese remainder theorem, Fermat's little theorem, Wilson's theorem.

**UNIT-II**

Number Theoretic Functions: Number theoretic functions for sum and number of divisors, Multiplicative function, The Mobius inversion formula, The greatest integer function. Euler's phi-function and properties, Euler's theorem.

**UNIT-III**

Primitive Roots: The order of an integer modulo n, Primitive roots for primes, Composite numbers having primitive roots; Definition of quadratic residue of an odd prime, and Euler's criterion.

**UNIT-IV**

Quadratic Reciprocity Law and Public Key Encryption: The Legendre symbol and its properties, Quadratic reciprocity, Quadratic congruencies with composite moduli; Public key encryption, RSA encryption and decryption.

**Recommended Readings:**


- Burton, David M. (2007). Elementary Number Theory (7th ed.). Tata Mc-Graw Hill Edition, Indian Reprint.
- Jones, G. A., &Jones, J. Mary. (2005). Elementary Number Theory. Undergraduate Mathematics Series (SUMS). First Indian Print.
- Neville Robinns. (2007). Beginning Number Theory (2nd ed.). Narosa Publishing House Pvt. Limited, Delhi.

**DCSC-404: Basic Electronics**

| | |
|---|---|
| Credits: 2L+0T+1P | Marks 75 |
| Contact hours per week: 5 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |
| **Total Marks** | 75 | | 30 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** On completion of the course, the student teacher will be able to-

- Recognize and use different tools/materials/instruments.
- Develop the skills for making simple projects/models.
- Acquire skill to assemble/prepare simple electric circuits.
- Acquire skill to use electronic components.
- Identify faults in electronic components.
- Develop the ability in repairing simple instruments used at secondary level.
- Inculcate healthy values related to work culture.

**UNIT-I**

Symbols, Tools and Soldering: Precautions used for making any electrical connection, Identification of conductors & insulators, Symbols for electrical components, knowledge of electrical accessories and their rating, Tools used for making any electrical connection, their sizes and use,
Hand soldering, Soldering alloy, soldering flux and desoldering pump, Practice of hand soldering.

**UNIT-II**

Wires, Wirings and connections of lamps: Different types of wire, use of SWG, Different types of wiring such as: Batten wiring, CTS wiring, casing capping wiring, Cleat and conduit wiring. Their advantage and disadvantage on each other. Series and parallel connections of lamps (up to four lamps). Staircase wiring of one, two and three lamps, Godown wiring, connection for fan.
Switches and Measuring Devices:Selection of fuse wire and use of DP and TP Switches. Knowledge of power consumed in Different Electrical and electronics gadgets.
Testing of energy meter, connection of energy meter and checking of electrical bills, Construction of Multi meter and knowledge of measuring the current, voltage and resistance in any circuit by using multimeter.

**UNIT-III**

Electrical Components and Appliances:Color coding in resistor and Capacitor, use of resistor and capacitor in electrical appliances,
Understanding the working of electrical appliances: Electric iron, room heater, Immersion heater, geyser, Electric bell, emergency light

**UNIT-IV**

Electronic Components and Their Use:Semiconductor materials, Semiconductor diode, Diode testing, Zener diode, LED, Photo diode, Solar cell, Rectification by diodes, Voltage multiplication by diodes.

**Practical:**

Preparation of Projects/Models based on the following (Only Suggestive)

- Clap switch
- IR Remote switch (fan, tube light)
- Remote operated musical bell
- Alarm for luggage security
- Mobile cell-phone charger using cell
- Power supply failure alarm
- Blown fuse indicator
- Rectifier
- Voltage Multiplier
- Transistor Amplifier

**Modes of Learning Engagement:** Constructivist Approach: Hands on Experiences, Activity based Learning, Experimentation, and Interactive engagement. Group Work, Peer Learning, Project Work.

**DCSC-405: Vector, Diseases & Management**

| | |
|---|---|
| Credits: 2L+0T+1P | Marks 75 |
| Contact hours per week: 5 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |
| **Total Marks** | 75 | | 30 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** After successfully completing the course, the students will be able to:

- Learn in detail of insect, vector diseases
- Identify in detail with examples insect, vector diseases
- Deliberate the detail of insect, vector diseases
- Learn in depth Insect, vectors and diseases

**UNIT-I**

a) Introduction to Insects
b) General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits
c) Concept of Vectors: Brief introduction of Carrier and Vectors (mechanical and biological vector),
d) Reservoirs, Host-vector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity Insects as Vectors

**UNIT-II**

a) Classification of insects up to orders, detailed features of orders with insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera
b) Dipteran as Disease Vectors
c) Dipterans as important insect vectors – Mosquitoes, Sand fly, Houseflies;
d) Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis; Control of mosquitoes

**UNIT-III**

a) Study of sand fly-borne diseases – Visceral Leishmaniasis, Cutaneous
b) Leishmaniasis, Phlebotomus fever; Control of Sand fly
c) Study of house fly as important mechanical vector, Myiasis, Control of house fly
d) Siphonaptera as Disease Vectors

**UNIT-IV**

a) Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases –Plague, Typhus fever; Control of fleas Siphunculata as Disease Vectors
b) Human louse (Head, Body and Pubic louse) as important insect vectors; Study of louse-borne diseases – Typhus fever, Relapsing fever, Trench fever, Vagabond's disease, Phthiriasis; Control of human louse
c) Hempitera as Disease Vectors
d) Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors, Control and prevention measures

**Practical:**

- Identification of General Features of Insects, Morphological features, Head – Eyes, appendages, and mouth parts w.r.t. feeding habits.
- Studies on Parasitic Adaptations.
- Preparation of smear of Gram positive and Gram negative Bacteria.
- Culture media preparation (Bacteria)
- Protozoan culture.
- Studies of Permanent Slides of: Mosquitoes and their Mouthparts, Housefly and its Mouthparts, Mouthparts of Blood sucking bugs, Blood smear showing various stages of Malaria parasite.

**Suggested Readings:**


- Roy, D.N. and Brown, A.W.A. 1970. Entomology (Medical and Veterinary) including insecticides & insects & Rat control; The Bangalore Printing & Publishing Co. Ltd., Bangalore
- Ernst Mayr, E. G. Linsley and R. L. Usinger. 1953. Methods and Principles of Systematic Zoology.

- Gullan, P.J. and Cranston, P.S. 1994. The Insects - An Outline of Entomology.
- William S. Romoser. 1973. The Science of Entomology.
- Robert G. Foottit and Peter H. Adler. 2009. Insect Biodiversity - Science and Society. Ed. Wiley-Blackwell.
- Service, M.W. 1980. A Guide to Medical Entomology.
- Kenneth G. V. Smith. 1973. Insects and other Arthropods of Medical Importance.
- Harold Oldroyd. 1973. Collecting, preserving and studying insects.
- Burgess, N.R.H and Cowan, G.O. 1993. A colour atlas of medical entomology.
- Black IV, W.C. and Mustermann, L.E. 1996. Molecular taxonomy and systematics of arthropod vectors. In: The Biology of Disease Vectors (eds. B.J. Beaty and W.C. Marquardt). Pp.438-70. University Press of Colarado.
- Hill, S.M. and Crampton, J.M. 1994. DNA-based methods for the identification of insect vectors. Ann. Trop. Med. Parasitol. 88 : 227-50.
- Barraud P.J. 1934. The fauna of British India, including Ceylon and Burma. Diptera, Family Culicidae, Tribes Megarhini and Culicine. Today & Tomorrow's Printers & Publihers. Published under the authority of the Secretary of State for India in Council. Pp371.
- Christophers S.R. 1933. The fauna of British India, including Ceylon and Burma. Diptera, Family Culicidae, Tribe Anophelini. Today & Tomorrow's Printers & Publihers. Published under the authority of the Secretary of State for India in Council. Pp314.


**DCBO-401: Biosystematics and Anatomy**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** After successfully completing the course, the students will be able to:

- Know the fundamental concepts of artificial, natural and phylogenetic system of classification
- Classify the Bentham & Hooker, Engler & Prantle and Hutchinson system

- Process the Herbarium; Tools and techniques
- Know the Botanical Nomenclature: Principles and rules of ICBN
- Process different types of Plant tissues
- Differciate the anatomy of root, stem leaves
- Apply the knowledge of tissue system to differentiate monocot and dicot root, stem and leaves

**UNIT-I**

Angiosperms: Origin and evolution; primitive angiosperms. Diversity in plant forms-annuals, biennials and perennials; convergence of evolution of tree habit in monocotyledons and di-cotyledons, trees-largest and longest lived seed plants.

**UNIT-II**

Botanical Nomenclature: Principles and rules of ICBN, type of concept, taxonomical categories, principle of priority, identification keys, floras.

Herbarium; Tools and techniques, important herbaria and botanical gardens of India and their importance.

**UNIT- III**

**Flower:** A modified shoot; development, structure and function of anther and pistil; Development of male and female gametophytes; Types of pollination; attractions and rewards for pollinators.
**Fertilization:** Double fertilization, Apomixis, Parthenocarpy
**Embryo:** Embryo development in Dicots and monocots; Polyembryony.
**Endosperm:** Types, development, structure and functions of endosperm, haustorial and ruminate endosperm.
**Fruits:** Development and types of fruits.

**UNIT- IV**

The basic body plan of a flowering plant; Types of Tissue and Tissue System.
**The shoot system:** The shoot apical meristems and its histological organization; vascularization of primary shoot in monocotyledons and dicotyledons; cambium and its functions; formation of secondary xylem; a general account of wood; characteristics of growth rings, sapwood and heart wood; secondary phloem – structure – function relationships; periderm
**Leaf:** Origin, development, arrangement and internal structure; adaptations to water stress

**The root system:** The root apical meristem and its organisation; differentiation of primary and secondary tissues and their roles; structural modifications for storage, respiration, reproduction and for interaction with microbes.

**Suggested Readings**


- Davis, P.H. and Heywood, V.H. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd, London.
- Heywood, V.H. and Moore, D.M. (eds) 1984. Current Concepts in Plant Taxonomy. Academic Press. London. 62 Jaffrey, C, 1982. an Introduction to Plant Taxonomy, Cambridge University Press, Cambridge, London.
- Jones, S.B., Jr. and Luchsinger, A.E. 1986. Plant Systematics (2nd edition). Mc Graw-Hill Book Co., New York.
- Maheshwari, J.K. 1963. Flora of Delhi, CSIR, New Delhi.
- Radrord, A.E. 1986. Fundamentals of Plant Systematics. Harper and Row, New York.
- Singh, F. 1999. Plant Systematics: theory and Practice. Oxford and IBH Pvt. Ltd., New Delhi.
- State, C.A. 1989. Plant Taxonomy and Biosystematics (2nd edition). Edward Arnold, London


**PRACTICALS**

- Familiarity with the terms used in technical description of plants.
- Study of representative plants of families included in the syllabus.
- Study of economically important plants with their uses.

**DCCH-401: General Chemistry-III**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes:** By the end of this course, students will be able to:

- Derive mathematical expressions for different properties of gases and liquids and understand their physical significance.
- Chemistry of inner transition elements (Lanthanide and Actinides).
- Reflet the concepts of stereochemistry and its role in determining the three-dimensional arrangement of molecules.
- Idenify and apply the General concepts, principles, kinetics and methodology of polymers.
- Perform and demonstrate varoius concepts involved in quantitative analysis and Organic synthesis.

**UNIT – I**

**Gaseous and Liquid State:**

Gaseous State- Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation, collision frequency, collision diameter, mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity, calculation of $\sigma$ from $\eta$, variation of viscosity with temperature and pressure, Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities, Behaviour of real gases: Deviations from ideal gas behaviour, compressibility factor, Z, and its variation with pressure for different gases, Causes of deviation from ideal behaviour, Van der Waals equation of state, its derivation and application in explaining real gas behaviour, mention of other equations of state (Berthelot, Dietrici), virial equation of state, van der Waals equation expressed in virial form and calculation of Boyle temperature, Isotherms of real gases and their comparison with van der Waals

isotherms, continuity of states, critical state, relation between critical constants, van der Waals constants and law of corresponding states

**Liquid state-** Qualitative treatment of the structure of the liquid state, Radial distribution function, physical properties of liquids, vapour pressure, surface tension and coefficient of viscosity, and their determination, Effect of addition of various solutes on surface tension and viscosity, Explanation of cleansing action of detergents, Temperature variation of viscosity of liquids and comparison with that of gases, and Qualitative discussion of structure of water.

**UNIT – II**

**Chemistry of Lanthanide and Actinide:** Chemistry of Lanthanides: occurrence and separation, Electronic configuration, oxidation states, colour, spectral and magnetic properties, lanthanide contraction, complex formation and applications,

Chemistry of Actinides: Electronic configuration, oxidation states, colour, spectral and magnetic properties, actinide contraction, complex formation and applications, chemistry of separation of Np, Pu and Am from Uranium, similarities between the later actinides and lanthanides.

**UNIT – III**

**Stereochemistry:**

Concept of isomerism, Types of isomerism; Optical isomerism – elements of symmetry, molecular chirality, enantiomers, stereogenic center, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemisation, Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature, Geometric isomerism – determination of configuration of geometric isomers, E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds, Conformational isomerism – conformational analysis of ethane and n-butane, conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives, Newman projection and Sawhorse formulae, Fischer and flying wedge formula, Difference between configuration and conformation.

**UNIT – IV**

**Macromolecules and Surface Chemistry:**

Macromolecules - Nomenclature, classification, properties of polymer, mass of macromolecules, number average and weight average molecular mass, determination of molecular weight by osmotic pressure, viscosity and light scattering and sedimentation methods.

Surface Chemistry- Sorption at surfaces, physical and chemical adsorption, factors affecting adsorption, Freundlich, Langmuir and Gibbs adsorption isotherms and their derivation, estimation of surface area (BET equation), Streaming potential electrophoresis and elctrosmosis.

**Suggested Readings:**


- Atkins, P.W.; Paula, J.de. (2014), Atkin's Physical Chemistry Ed., 10th Edition, Oxford
- Principles of Physical Chemistry, B.R. Puri & L.R. Sharma, Shoban Lal Nagin Chand & Co.
- Castellan, G. W. (2004), Physical Chemistry, 4th Edition, Narosa.
- Kapoor, K.L. (2015), A Textbook of Physical Chemistry, Vol 1, 6th Edition, McGraw Hill Education.
- Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
- Cotton, F.A., Wilkinson, G. &Gaus, P.L. *Basic Inorganic Chemistry*, 3rd ed., Wiley.
- Douglas, B.E., McDaniel, D.H. & Alexander, J.J. *Concepts and Models in Inorganic Chemistry*, John Wiley & Sons.
- Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. *Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson Education India, 2006.
- Sykes, P. *A Guidebook to Mechanism in Organic Chemistry,* Orient Longman, New Delhi (1988).
- 12. Eliel, E.L. *Stereochemistry of Carbon Compounds*, Tata McGraw Hill education, 2000.
- 13. Eliel, E.L., Wilen, S.H. (1994), Stereochemistry of Organic Compounds; Wiley: London.
- 14. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education)..
- 15. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005.

- Barrow, G.M. *Physical Chemistry* Tata McGraw-Hill (2007).
- Physical chemistry by S. Glasston.
- Micelles: Theoretical and applied aspects YoshikiyoMoroi, Springer Publications.
- Physical Chemistry, Puri Sharma nad Pathania, Vishal Publication.
- Physical Chemistry, Beli & Tuli, S. chand Publication, Delhi.
- Introduction to Polymer Science, V.R. Gawariker, N.V. Vishwanathan & J. Shridhar, Wiley Eastern.


**Practical-IV Minor**

**Credit of the Course:** 1

**Syllabus:**

1. **Quantitative Analysis: Volumetric Analysis**
   a) Quantitative estimation of one metal volumetrically from a given mixture.
   b) To estimate magnesium volumetrically from a mixture containing $Ba^{2+}$ and $Mg^{2+}$ Ions/ $Zn^{2+}$ and $Mg^{2+}$ ions.
   c) To estimate copper iodometrically from a given mixture containing $Pb^{2+}$ and $Cu^{2+}$ ions.
   d) Estimation of Glucose with the help of Fehling's solution.
   e) Determination of Total hardness of water.
2. **Synthesis of Inorganic complexes and organic compounds**
   Inorganic Complexes.
   a) Preparation of sodium trisoxalato ferrate (III)
   b) preparation of Tetraamine copper (II) sulpahte
   Organic Synthesis (One Step)
   a) Acetylation of salicylic acid, aniline,
   b) Aliphatic electrophilic substitution: Preparation of iodoform from ethanol and acetone.
3. **Viva-Voce**
4. **Evaluation of record book of experiments performed in semester.**

**DCMA-401: Partial Differential Equation**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)

C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Partial Differential Equation (Minor/Major)**

Course Learning Outcomes: After completion of this course the student will be able to:

i) Formulate and classify the partial differential equations.
ii) Solve linear and non-linear partial differential equations using various methods; and apply these methods in solving physical problems.

**UNIT-I**

Linear partial differential equations of the first order, Lagrange's method, Non-linear partial differential equations of the first order, Charpit's method for solution.

**UNIT-II**

Homogeneous and non- homogeneous partial differential equations with constant coefficients, partial differential equations reducible to equations with constant coefficients, Monge's method.

**UNIT- III**

Classification of second order partial differential equations, reduction to canonical form.

**UNIT-IV**

Method of separation of variables for second order PDE, Existence and uniqueness of solution of vibrating string problem, Heat conduction problem, Existence and uniqueness of solution of heat conduction problem.

**Recommended Readings:**

- Ordinary and Partial Differential Equations, M. D. Raisinghania and R. S. Aggarwal, S. Chand & Company, New Delhi, 2ndedition 1983.
- Theory and problems of Differential equations, Frank Ayres, McGraw-Hill Book Company, Singapore, 1stedition 1972.

**DCPY-401: Thermal Physics**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |

| | | | |
|---|---|---|---|
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** Student teachers will be able to:

- Discuss different concepts of kinetic theory of gases.
- Explain ideal & real gases and liquefaction of gases.
- Discuss transport phenomena in gases.
- Explain the different laws of thermodynamics.
- Apply thermodynamic laws in functioning of heat engines.
- Apply Maxwell's thermodynamic relations in different situations.

**UNIT-I**

Ideal Gas: Kinetic theory of gases, deduction of Boyle's law, interpretation of temperature, estimation of rms speeds of molecules, Brownian motion, estimate of the Avogadro number, Equipartition of energy, specific heat of monoatomic gas, extension to diand triatomic gases, Behaviour at low temperatures, Adiabatic expansion of an ideal gas, applications to atmospheric physics.

Real Gas: Van der Waals gas, equation of state, nature of Van der Waals forces, comparison with experimental P-V curves, The critical constants, gas and vapour, Joule expansion of ideal gas and of a Vander Waals gas, Joule coefficient, Joule Thomson effect.

**UNIT-II**

Liquefaction of gases: Boyle temperature and inversion temperature, Principle of regenerative cooling and of cascade cooling, liquefaction of hydrogen and helium, Refrigeration cycles, meaning of efficiency. Transport phenomena in gases: Molecular collisions mean free path and collision cross sections, Estimates of molecular diameter and mean free path, Transport of mass, momentum and energy and interrelationship, dependence on temperature and pressure.

**UNIT-III**

The laws of thermodynamics: The Zeroth law, various indicator diagrams, work done by and on the system, first law of thermodynamics, internal energy as a state function, reversible and irreversible changes, Carnot cycle and its efficiency, Carnot theorem and the second law of thermodynamics, Different versions of the second law, practical cycles used in internal combustion engines, Entropy, principle of increase of entropy, The thermodynamic scale of temperature, its identity with the perfect gas scale, Impossibility of attaining the absolute zero temperature, third law of thermodynamics

**UNIT-IV**

Thermodynamic relationships: thermodynamic variables- extensive and intensive, Maxwell's general relationships, application to Joule – Thomson expansion and adiabatic cooling in a general system, Van der Waals gas, Clausius-Clapeyron heat equation, Thermodynamic potentials and equilibrium of thermodynamical systems, relation with thermodynamical variables, cooling due to adiabatic demagnetization, production and measurement of very low temperatures.

**Practical:**

- To determine the thermal conductivity of bad conductor by Lee's method.
- To determine the melting point of wax using platinum resistance thermometer.
- To find 'J' by Call ender and Barne's method.
- To study the temperature dependence of resistance for thermistor and find temperature coefficient of resistance and material constant.
- To study the temperature dependence of resistance of a torch bulb's filament.
- Determine the Heat capacity of a Brass.

**Suggested Readings:**

- Thermal Physics: B.K. Agarwal.
- Heat and Thermodynamics: Brij Lal and N. Subramanyam.
- Heat and Thermodynamics: Dayal, Verma and Pandey.
- A Treatise on Heat: M.N. Saha and B.N. Srivastava.
- Heat and Thermodynamics: K.W. Zemansky.
- Thermal Physics, S.C. Garg, R.M. Bansal, C.K. Ghosh.

## DCZO-401: Ethology and Economic Zoology

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** After successfully completing the course, the students will be able to:

- Develop skills, concepts and experience to understand all aspects of animal behaviour. Objectively understand and evaluate information about animal behaviour encountered in our daily lives.
- Recognize the Economical prospective of Zoology and Animal Behaviour
- Know the Bee keeping equipments and apiary management.
- Apply and be able to objectively evaluate the role of behaviour in the protection and conservation of animals in the wild.
- evaluate behaviour of all animals, including humans, in the complex ecological world, including the urban environment

### UNIT-I

a) Introduction and history of Ethology. Brief profiles of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen, Proximate and ultimate causes of behaviour, Methods and recording of a behaviour

b) Patterns of Behaviour: Stereotyped Behaviours (Orientation, Reflexes); Individual Behavioural patterns; Instinct vs. Learnt Behaviour; Associative learning, classical and operant conditioning, Habituation, Imprinting.
c) Motion: Classification of directional movements:- kinesis, tropism & taxes

**UNIT-II**

a) Communication: Definition, types of signal (touch, sound, Chemical, and visual),
b) Social Behaviour: Concept of Society; Communication and the senses; Altruism; Insects' society with Honey bee as example; Foraging in honey bee and advantages of the waggle dance.
c) Sexual Behaviour: Asymmetry of sex, Sexual dimorphism, Mate choice, Intra-sexual selection (male rivalry), Inter-sexual selection (female choice), Sexual conflict in parental care.

**UNIT-III**

a) Insects of Economic Importance: Biology, Control and damage caused by *Helicoverpa armigera*, *Pyrilla perpusilla* and *Papilio demoleus*, *Callosobruchus chinensis*, *Sitophilus oryzae* and *Tribolium castaneum*
b) Insects of Medical Importance: Medical importance and control of *Pediculus humanus corporis*, *Anopheles*, *Culex*, *Aedes*, *Xenopsylla cheopis*
c) Animal Husbandry: Preservation and artificial insemination in cattle; Induction of early puberty and synchronization of estrus in cattle
d) Poultry Farming: Principles of poultry breeding, Management of breeding stock and broilers, Processing and preservation of eggs
e) Fish Technology: Genetic improvements in aquaculture industry; Induced breeding and transportation of fish seed

**UNIT-IV**

a) Economic Importance of Invertebrates (Apiculture, Aquaculture, Sericulture).
b) Insects as pests and their management
c) Economic Importance of vertebrates (Fish culture and Poultry culture.)
d) Wild life of India, causes of depletion of wild life, modes of wild life conservation, Red data book. Environmental legislations (Wildlife Protection Act, Environment act. Biodiversity act). Wild life scenario in and around central foot hills of the Aravalli and the Thar Desert.

**Practical:**

- Demonstration of Phototactic responses by *Tribolium* / House fly / *Drosophila*.
- Demonstration of Geotactic responses by Earthworm.
- To study nests and nesting habits of the birds and social insects.
- To study the behavioural responses of wood lice to dry and humid conditions.
- Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park to study behavioural activities of animals and prepare a short report.
- Study of *Plasmodium vivax*, *Entamoeba histolytica, Trypanosoma gambiense*, *Ancylostoma duodenale* and *Wuchereria bancrofti* and their life stages through permanent slides/photomicrographs or specimens.
- Study of arthropod vectors associated with human diseases: *Pediculus*, *Culex, Anopheles*, *Aedes* and *Xenopsylla*.
- Study of insect damage to different plant parts/stored grains through damaged products/photographs.
- Identifying feature and economic importance of Helicoverpa (*Heliothis*) *armigera*, *Papilio demoleus, Pyrilla perpusilla*, *Callosobruchus chinensis*, *Sitophilus oryzae* and *Tribolium castaneum*
- Visit to poultry farm or animal breeding centre. Submission of visit report
- Maintenance of freshwater aquarium

**Suggested Readings:**


- Animal Ecology by S.P. Singh 6th Revised Edition – Rastogi Publications,2008
- Animal Ecology and Biostatistics. KC Soni Hindi Edition college book centre, Chaura Rasta, Jaipur
- Mammalian Endrocrinology and Animal Behavior, VS Pawar, Hindi Edition, College book centre, Chaura Rasta

- David McFarland, Animal Behaviour, Pitman Publishing Limited, London, UK.
- Manning, A. and Dawkins, M. S, An Introduction to Animal Behaviour, Cambridge, University Press, UK.
- John Alcock, Animal Behaviour, Sinauer Associate Inc., USA.
- Paul W. Sherman and John Alcock, Exploring Animal Behaviour, Sinauer Associate Inc., Massachusetts, USA.
- Chronobiology Biological Timekeeping: Jay. C. Dunlap, Jennifer. J. Loros, Patricia J. DeCoursey (ed). 2004, Sinauer Associates, Inc. Publishers, Sunderland, MA, USA
- Insect Clocks D.S. Saunders, C.G.H. Steel, X., Afopoulou (ed.) R.D. Lewis. (3rdEd) 2002 Barens and Noble Inc. New York, USA
- The Clock that times us. 1982. Moore Ed et al.
- Biological Rhythms: Vinod Kumar (2002) Narosa Publishing House, Delhi/ Springer-Verlag, Germany.


**PCMA-401: Content cum Pedagogy of Mathematics (CCPM-I)**

| | |
|---|---|
| Credits: 1L+1T+0P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

Mathematics is an important school subject and students are expected to master computational and problem-solving skills with the help of mathematical concepts and reasoning during study. Teaching of Mathematics is not only concerned with the computational know-how of the subject but is also concerned with pedagogical content knowledge and communication leading to its meaningful learning amongst students. This course enables the student-teachers to understand the nature of mathematical knowledge and the mathematics curriculum at secondary stage. The objectives of teaching Mathematics should not be limited to the development of computational skills but to enable mathematical reasoning to solve problems of life. Student teachers will develop skills to formulate classroom objectives as well as plan for development of the values through Mathematics. Student teachers will have a thorough understanding of Mathematics content and their relevant specific pedagogy for the effective learning of

Mathematics. They would be exposed to various pedagogical approaches, methods, and techniques so that they will be able to create a learner friendly classroom environment.

**Course Learning Outcomes**

After completion of this course, student teachers will be able to:

- appraise the contribution of Indian Knowledge Systems in development of Mathematics,
- explain the nature of Mathematics as an important subject for human development,
- interpret the recommendation of the various policy documents in reference to Mathematics education,
- classify the aims and objectives of teaching Mathematics,
- formulate objectives based on learning outcomes for Mathematics teaching,
- select and demonstrate various approaches and methods of teaching Mathematics,
- plan strategies to inculcate values through teaching Mathematics.

**UNIT - I**

Nature, Scope and Historical Perspective of Mathematics

a) Development of Mathematics from a historical perspective.
b) Nature of Mathematical Knowledge – Axioms and Postulates, Conjectures, Proofs in Mathematics: inductive - deductive reasoning, theorems, mathematical modeling.
c) Importance of Mathematics knowledge in everyday life.
d) Recommendations of various committees, commissions and policies related to Mathematics education at Secondary stage (especially in National Education Policies and National Curriculum Frameworks).

**UNIT - II**

Aims and Objectives of Teaching Mathematics

a) Aims and objectives of teaching Mathematics at secondary stage.
b) Learning outcomes and competencies of teaching Mathematics at secondary stage.
c) Linkages of Mathematics with other school subjects and place in school curriculum.
d) Inculcation of values through teaching of Mathematics.

**UNIT - III**

Pedagogical Aspects of Mathematics

a) Implication of various approaches of teaching Mathematics – inductive deductive, analytical synthetical, constructivist, blended learning, experiential learning, transdisciplinary, interdisciplinary, and multidisciplinary.
b) Learner-centric and participative methods of teaching of Mathematics: lecture cum demonstration, problem-solving, laboratory, project based.
c) Analytical pedagogical concerns in teaching of Mathematics for higher order thinking skills such as critical, creative, decision making, reflective, collaborative, and cooperative.
d) Techniques of teaching learning Mathematics: oral, written, drill work, homework, self- study, group study, supervised study, concept-mapping, learning, art and sports integrated learning.

**Suggestive Practicum (Best out of Two)**

- Prepare a collage/ biographic sketch on the contribution of Indian mathematician.
- Present a paper on comparison of nature of mathematical knowledge with other school subjects.
- Formulate objectives based on learning outcomes and experiential learning for any one unit of secondary Mathematics.
- Develop strategy to connect any three topics for value inculcation in teaching of Mathematics.
- Analyze the content of one chapter of Mathematics textbook and develop concept maps at secondary stage.
- Select and list approaches and methods for teaching various topics of secondary stage Mathematics.
- Any other project assigned by HEI.

**Suggestive Mode of Transaction**
Demonstration, field-based experience, library visits, classroom discussions, self-study, field observations, assignment preparation, classroom presentations, discussion forums, observation, research report, engaging in dialogue, flipped classroom.

**Suggestive Mode of Assessment**
Written test, classroom presentation, workshop, assignments, practicum, sessional and terminal semester examination.

**Suggestive Reading Material**
- MESE 001(2003) Teaching and Learning Mathematics. IGNOU series
- NCERT Publications: Pedagogy of Mathematics (Code-13074)

*Teachers may also suggest books/readings as per the need of the learners and learning content

**PCPS-402: Content cum Pedagogy of Physical Sciences (CCPPS-I)**

| | |
|---|---|
| Credits: 1L+0T+1P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**
The focus of the National Education Policy (NEP) 2020 is on the holistic development of students. To achieve the objectives, interventions from quality teachers are vital. Sound pedagogical content knowledge and teaching methods are the determinants of a teacher's quality and professionalism. Teacher education programme strongly emphasizes pedagogy, its principles, and the practices of teaching and learning. Pedagogical knowledge and approaches refer to the specialized knowledge of the teacher for creating an active, child-centered, and inclusive teaching-learning environment for the students and need to be developed among the student teachers. This pedagogical course in Physical Sciences is intended to enhance the pedagogical content knowledge of student teachers through different learning approaches and methods. This course comprises three units and a practicum. The

course is devoted to developing an understanding of the nature and scope of Physical Sciences and the aims and objectives of teaching Physical Sciences and its linkages with other disciplines. Historical/policy perspectives of Physical Sciences are discussed in unit second. Physical Sciences is conceptualized in very broad terms by relating it to technology, society, humans, and sustainable development. It also focuses on the place of Physical Sciences in school curriculum including an emphasis on how to build inclusive classrooms. It focuses on pedagogical concerns of Physical Sciences. Critical, creative, and analytical pedagogical concerns in teaching Physical Sciences with special reference to higher-order thinking are also placed in unit third.

**Course Learning Outcomes**

After completion of this course, student teachers will be able to:

- explain nature, scope and importance of Physical Sciences,
- illustrate aims and objectives of teaching Physical Sciences for sustainable development of society,
- outline linkages between Physical Sciences and other subjects,
- identify the values and importance of Physical Sciences and alternative knowledge systems,
- summarize the historical/policies perspective of Physical Sciences,
- examine pedagogical concerns of Physical Sciences,
- categorize approaches and methods of teaching learning Physical Sciences,
- apply appropriate pedagogy in teaching learning the concepts of Physical Sciences.

**UNIT - I**

Nature, Scope and Historical Perspective of Physical Sciences

a) Nature, scope, and importance of Physical Sciences.
b) Historical perspective of Physical Sciences.
c) Contributions of Indian (ancient and modern) and other scientists.
d) Physical Sciences, society and human and sustainable development.
e) Recommendations/suggestions of various committees, commissions, and policies in reference to Physical Sciences.

**UNIT - II**

Aims and Objectives of Physical Sciences

a) Aims and objectives of teaching Physical Sciences.
b) Learning outcomes and competencies of teaching Physical Sciences at secondary stage.
c) Linkages of Physical Sciences with other school subjects and place of the Physical Sciences in school curriculum.
d) Values of Physical Sciences: scientific attitude and appreciating other systems of knowledge / alternative knowledge systems.

**UNIT - III**

Pedagogical Aspects of Physical Sciences

a) Implication of various approaches - inductive deductive, constructivist, experiential learning, art integrated learning, sports integrated learning, blended learning, interdisciplinary and multidisciplinary approaches in Physical Sciences.
b) Analytical pedagogical concerns in teaching of Physical Sciences for higher order thinking skills such as critical, creative, communication, decision making, reflective.
c) Methods of teaching learning Physical Sciences: learner-centric and group-centric, lecture cum demonstration, activity based, discussion, problem-solving, laboratory, stem and steam, project based, scientific inquiry, hands on activity, discovery, experimentation, concept-mapping, collaborative and cooperative learning.

**Suggestive Practicum (Best out of Two)**

- Explore contributions of Indian scientists in the development of Physical Sciences and make presentations on historical development of Physical Sciences.
- Analyze recommendations of policies/commissions in context of Physical Sciences.
- Develop concept maps on different concepts of Physical Sciences.
- Identify and integrate values in Physical Sciences concepts.

- Demonstrate different pedagogical approaches and strategies for transacting concepts of Physical Sciences.
- Prepare write-ups on the teaching of science using interdisciplinary and multidisciplinary approaches as recommended in NEP 2020.
- Any other project assigned by HEI.

**Suggestive Mode of Transaction**
Lecture cum discussion/demonstration, hands-on activities, experiential learning, art and environment integrated learning, sports integrated learning.

**Suggestive Mode of Assessment**
Written tests, classroom presentations, workshops, seminars, assignments, practicums, sessional and terminal semester examinations.

**Suggestive Reading Material**
- National Council of Educational Research and Training. (April 2022). Mandate documents Guidelines for the development of National Curriculum Frameworks.
- National Education Policy 2020, MoE, Government of India.
- National Steering Committee for National Curriculum Frameworks, (2023). Draft National Curriculum Framework for School Education.
- NCERT, Textbooks of Physical Sciences at Secondary Stage.

*Teachers may also suggest books/readings as per the need of the learners and learning content

**PCBS-403: Content cum Pedagogy of Biological Sciences (CCPBS-I)**

| | |
|---|---|
| Credits: 1L+0T+1P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

Biology is an inseparable part of human life and is hence learning biological concepts and principles is given ample importance in school curricula. Knowledge of Biological Sciences enables students to recognize and value the diverse living forms, their structure and method of functioning, co-existence and how they harmoniously blend with other natural/physical factors that constitutes the complex environment. To enable school students adequately learn these aspects, teachers must design and adopt appropriate teaching-learning methods for teaching Biological Sciences. Biological Sciences offer us the unique facility of seeing, touching and observing materials. This course aims to educate the student teachers to learn the various methods and strategies in teaching Biological Sciences. The course comprises of three units describing the aims and scope of Biological Sciences in Secondary level. A glimpse of the history of Biological Sciences is dealt with ancient and modern Indian and international contributions in the study of biological methods and practices in building the modern-day Biological Sciences. Salient features of selected earlier curricular exercises with special reference to biology at secondary level are also emphasized.

**Course Learning Outcomes**

After completion of this course, Student teachers will be able to:

- explain nature, scope, and importance of Biological Sciences,
- illustrate aims and objectives of teaching Biological Sciences for sustainable development of society,
- outline linkages between Biological Sciences and other subjects,
- identify the values and importance of Biological Sciences and alternative knowledge systems,
- summarize the historical/policies perspective of Biological Sciences,
- examine pedagogical concerns of Biological Sciences,
- categorize approaches and methods of teaching learning Biological Sciences,
- apply proper pedagogy in teaching learning the concepts of Biological Sciences,
- realize the importance of studying Biological Sciences as part of the school curriculum,
- identify the values and significance of Biological Sciences in School curricula,
- apply appropriate method/s in teaching concepts of Biological Sciences.

**UNIT - I**

Nature, Scope and Historical Perspective of Biological Sciences

a) Nature, scope, and importance of Biological Sciences.
b) Historical perspective of Biological Sciences.
c) Contributions of Indian (ancient and modern) and other scientists.
d) Biological science for sustaining self, society, environment, and world.
e) Recommendations/suggestions of various committees, commissions, and policies in reference to Biological Sciences.

**UNIT - II**

Aims and Objectives of Biological Sciences

a) Aims and objectives of teaching biological science as a component of multidisciplinary science.
b) Learning outcomes and competencies of teaching Biological Sciences at secondary stage.
c) Linkages of Biological Sciences with other school subjects and place of the Biological Sciences in school curriculum.
d) Values of Biological Sciences; ethical, environmental and sustainability concerns.

**UNIT - III**

Pedagogical Aspects of Biological Sciences

a) Implication of various approaches – inductive deductive, constructivist, experiential, art-integrated, blended learning, interdisciplinary and multidisciplinary approaches, stimulating the spirit of investigation and enquiry.
b) Analytical pedagogical concerns in teaching of physical sciences for higher order thinking skills such as critical, creative, communication, decision making, reflective.
c) Methods of teaching learning Biological Sciences: learner-centric and group-centric, lecture cum demonstration, activity based, discussion, problem-solving, laboratory and hands on activity based, sports-integrated, project based, inquiry, discovery, experimentation, concept-mapping, collaborative and cooperative learning; stem and steam concept.

**Suggestive Practicum (Best out of Two)**

- Plot a timeline of development of Biological Sciences from ancient to modern times mentioning the important developments.
- Analyze and prepare a report on pedagogy of Biological Sciences with reference to NEP 2020.
- Prepare a write up on ancient Indian contributions and practices in Ayurveda/Herbal medicines.
- Develop concept maps on different concepts of Biological Sciences.
- Demonstrate different pedagogical approaches and strategies for transacting concepts of Biological Sciences.
- Any other project assigned by HEI.

**Suggestive Mode of Transaction**

Lecture cum discussion, demonstration, hands-on activities, experiential learning, inquiry, Group work, Presentations, multimedia.

**Suggestive Mode of Assessment**

Written tests, classroom presentations, workshops, seminars, assignments, practicums, sessional and terminal semester examinations.

**Suggestive Reading Material**

- National Council of Educational Research and Training. (April 2022). Mandate documents Guidelines for the development of National Curriculum Frameworks.
- National Education Policy 2020, MoE, Government of India.
- National Steering Committee for National Curriculum Frameworks, (2023). Draft National Curriculum Framework for School Education.
- NCERT, Textbooks of Biological Sciences at Secondary Stage.

*Teachers may also suggest books/readings as per the need of the learners and learning content

# SEMESTER

# V

**DCBO-501: Plant Physiology**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –

- Provide students with learning experiences that help in still deep interests in learning plant physiology.
- Equip students with appropriate tools of analysis and with theoretical, technical and analytical skills to tackle issues and problems in the field of plant physiology.
- know plants, water and environment relationship and plant nutrient uptake and translocation, photosynthesis, respiration.

**UNIT-I**

**Plant-water relations**: Importance of water to plant life; physical properties of water; diffusion and osmosis; DPD and water potential concept, absorption and transport of water: Transpiration and mechanism of opening and closing of stomata. Factors affecting transpiration.

**UNIT-II**

**Translocation of organic substances**: mechanism of phloem transport; source – sink relationship; factors affecting translocation.

**Mineral nutrition**: criteria of essentiality of elements; essential macro – and micro-elements and their role; mineral uptake; deficiency and toxicity symptoms; water culture technique; foliar nutrition.

**UNIT-III**

**Photosynthesis:** Historical aspects; photosynthetic pigments; action spectra and enhancement effect; concept of two photosystems; photophosphorylation; C3cycle; C4 cycle; CAM cycle; photorespiration; factors influencing photosynthesis; C3& C4 plants. Significance of photosynthesis.

**UNIT-IV**

**Respiration:** Aerobic and anaerobic respiration; respiratory substrates; Glycolytic pathway of glucose degradation to pyruvic acid; tricarboxylic acid cycle; electron transport mechanism (chemi – osmotic theory); redox potential; oxidative phosphorylation; pentose phosphate pathway. Factors affecting respiration.

**DCBO-502: Plant Physiology and Biochemistry**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –

- Provide students with learning experiences that help in still deep interests in learning plant biochemistry.
- Equip students with appropriate tools of analysis and with theoretical, technical and analytical skills to tackle issues and problems in the field of plant physiology.
- Know the nitrogen metabolism.
- Apply the effects of various factors on the growth and development of plants.

**UNIT-I**

**Nitrogen and lipid metabolism:** Biology of nitrogen – fixation; importance of nitrate reductase and its regulation; ammonium assimilation; structure and function of lipids; fatty acid biosynthesis; beeta-oxidation; saturated and unsaturated fatty-acids; storage and mobilization of fatty acids.

**UNIT-II**

**Growth and development:** Definitions; phases of growth and development; Growth Curve, kinetics of growth; seed dormancy, seed germination and factors of their regulation; plant movements;

**UNIT-III**

**Plant growth regulators-** auxins, gibberellins, cytokinins, abscisic acid and ethylene, history of their discovery, biosynthesis and mechanism of action, physiology of senescence, fruit ripening

**UNIT-IV**

The concept of photoperiodism; physiology of flowering; florigen concept; biological clocks; photomorphogenesis; phytochromes and cryptochromes, Vernalisation, their discovery, physiological role and mechanism of action.

**Suggested Readings:**


- Hopkins W.G. 1995, Introduction to Plant Physiology, John Willey & Sons, New York USA.
- Salisbury F.B. & Ross C.W. 1992 Plant physiology, Widsworth Publishing Co. California, U.S.A.
- Taiz L. & Zeiger E, 1998, Plant Physiology (Second Edition) Sinauer Associates Inc. Publishing U.S.A.


**PRACTICALS**
**Course Content**

**The following experiments are to be conducted:**

- Germination of non-dormant and dormant seeds.
- To demonstrate osmosis using egg membrane, onion/tomato peels, potato osmoscope.
- To study the effect of temperature and alcohol on the permeability of membranes.
- To demonstrate plasmolysis.
- To compare the water holding capacity of soils (clay, peat and sand).
- To demonstrate transpiration pull.
- To compare the rates of transpiration in different environmental conditions.
- To demonstrate the evolution of oxygen during photosynthesis.
- To compare the rates of photosynthesis under different environmental conditions.
- To demonstrate the necessity of light, CO2 and chlorophyll for photosynthesis.
- Separation of photosynthetic pigments by paper chromatography.
- Demonstration of aerobic respiration.
- Demonstration of anaerobic respiration.
- To demonstrate the liberation of CO2 during aerobic respiration

**DCCH-501: Inorganic Chemistry-III**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.

- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| Distribution Marks for the course | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes:** By the end of this course, students will be able to –

- Reflect upon fundamentals of organometallic compounds.
- Explain structure and synthesis of ferrocene.
- Describe the General reaction involved in organometallic catalysis.

Overall, the course aims to provide students with fundamentals about organometallic compounds, metal alkyls, metal carbonyls, catalysis and organometallic catalysis.

**UNIT-I**

**Magnetic Properties of Transition Metal Complexes:** Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula, L-S coupling, correlation of $\mu_s$ and $\mu_{eff}$ values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes.
Electrical & Magnetic Properties of Atoms and Molecules: Basic ideas of electrostatics, Electrostatics of dielectric media, Clausius-Mosotti equation, Lorenz-Laurentz equation, Dipole moment and molecular polarizability and their measurements, Diamagnetism, paramagnetism, magnetic susceptibility and its measurement, molecular interpretation.

**UNIT-II**

**Carbonyl and Nitrosyls**
Metallic carbonyls general methods of preparation, general properties, structure and nature of metal carbonyls, synergic effect, bonding in carbonyl, Effective atomic number (EAN) rules as applied to metallic carbonyl, 18 electron rules applied to metallic carbonyls, preparation, properties and structure of nickel tetracarbonyl, iron penta carbonyls, chromium hexa carbonyls, dimanganese deca carbonyl, dicobalt octa carbonyl.
Metallic Nitrosyls: some metallic nitrosyls, metal nitrosyl carbonyl, metal nitrosyl halides, sodium nitroprusside (preparation, properties, structures and uses) structure and nature of M-N bonding in nitrosyls. Effective atomic number (EAN) rules as applied to metallic nitrosyls.

**UNIT III**

**Organometallic Compounds:** Definition, nomenclature and classification of organometallic compounds on the basis nature of metal-carbon bond (ionic, s, p and multicentre bonds), Concept of hapticity of organic ligands, EAN rule, Structure and bonding of Π-bonded organometallics such as alkene and alkyne complexes, Zeise's salt: Preparation and structure, evidences of synergic effect and comparison of synergic effect with that in carbonyls, Metal Alkyls: Important structural features of methyl lithium (tetramer) and trialkyl aluminium (dimer), concept of multicentre bonding in these compounds, Role of triethylaluminium in polymerisation of ethene (Ziegler – Natta Catalyst), Species present in ether solution of Grignard reagent and their structures, Schlenk equilibrium,
Ferrocene: Preparation and reactions (acetylation, alkylation, metallation, Mannich Condensation), Structure and aromaticity, Comparison of aromaticity and reactivity with that of benzene.

**UNIT IV**

**Organometallic catalysis:** General reaction involved in organometallic catalysis like oxidative addition, migratory insertion, and reductive elimination, isomerization and rearrangement, Alkene metathesis, hydroboration, hydroamination, hydrosilation, hydrogenation, carbonylation, C-C coupling reactions,

Study of the following industrial processes and their mechanism: Alkene hydrogenation (Wilkinsons Catalyst), Hydroformylation (Co salts), Wacker Process, Synthetic gasoline (Fischer Tropsch reaction), Synthesis gas by metal carbonyl complexes.

**Suggested Readings:**


- Shriver & Atkins. Inorganic Chemistry, Peter Alkins, Tina Overton, Jonathan Rourke, Mark Weller and Fraser Armstrong, 5th Edition, Oxford University Press (2011-2012).
- Mehrotra R.C. and Singh, A. Organometallic Chemistry, New Age InternationalPublishers, 2nd Ed, 2000.
- Gupta B. D. and Elias A. J., Basic organometallic Chemistry, 2nd Ed., University Press (2013).
- Crabtree, R. H. The Organometallic Chemistry of the Transition Metals. NewYork, NY: John Wiley, 2000.
- Powell, P. Principles of Organometallic Chemistry, Chapman and Hall, 1988.
- Collman, J. P. et al. Principles and Applications of Organo-transitionMetalChemistry. Mill Valley, CA: University Science Books, 1987.
- Huheey J. E., Keiter E. A. and Keiter R. L., Inorganic Chemistry – Principles of structure and reactivity,Pearson Education, 4th Ed. 2002.
- Shriver D. E., Atkins P. W., InorganicChemistry, Oxford University Press,5th Ed.
- Das Asim K., Fundamentals of Inorganic Chemistry, Vol. II, CBS Publications, 2nd Ed.2010.
- Mallick, Madan and Tuli, Selected Topic in Inorganic Chemistry, S. Chand Publisher.17th Ed. 2010.
- Puri, Sharma, Kalia, Principles of Inorganic Chemistry, Vishal Pub. Co., 33rd ed., 2017.
- Cotton, F.A., Wilkinson, G., Murrillo, C. A., Bochmann, M., AdvancedInorganic Chemistry 6th Ed. 1999 Wiley.
- Boy Cornils, Wolfgang A. Herrmann, et al., Applied Homogeneous Catalysis with Organometallic Compounds: A Comprehensive Handbook in Four Volumes 3rd, 2017, Wiley.
- R.D. Adams, Comprehensive Organometallic Chemistry II, Volume 10: Heteronuclear Metal and Metal Bonds 1st Ed., 2004 Pergamon.


## DCCH-502: Organic Chemistry-III

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)

C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes:** By the end of this course, students will be able to –

- Apply and recognize various cocnpets of diffent spectral techniques, principles, instrumentation and applications of UV-Visible, FT-IR spectroscopy.
- Interpret NMR spectra to determine the structure and composition of organic compounds, including the identification of functional groups and stereochemistry.
- Apply the chemistry of alkaloids, steroids & terpenes in daily life and steps inlvoved in structure elucidation.
- Perform, demonsrate and develop various skills involved in separation and synthesis of organic compounds.

**UNIT-I**

**UV-Vis Spectroscopy:** Types of electronic transitions, $\lambda_{max}$, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption, Application of Woodward Rules for calculation of $\lambda_{max}$ for the following systems: α,β unsaturated aldehydes, ketones, carboxylic acids and esters, Conjugated dienes: alicyclic, homoannular and heteroannular, Extended conjugated systems (aldehydes, ketones and dienes); distinction between cis and trans isomers, Instrumentation (choice of source, monochromator and detector) for single and double beam instruments, and applications of UV-Vis spectroscopy,

**UNIT-II**

**IR Spectroscopy:** Basic principle, Hooke's law, mode of molecular vibrations, IR absorption positions of O, N and S containing functional groups, Effect of H-bonding, conjugation, resonance and ring size on IR absorptions, Fingerprint region and its significance, application in functional group analysis, Instrumentation (choice of source, monochromator& detector), sampling techniques and applications of IR spectroscopy.

**UNIT-III**

**Nuclear magnetic resonance (NMR) spectroscopy:** Spectroscopy, proton magnetic resonance ($^1$H NMR) spectroscopy, nuclear shielding and deshielding, Chemical shifts and molecular structure, spin-spin splitting and coupling constants, areas of signals, Anisotropic effects in alkene, alkyne, aldehydes and aromatics, interpretation of 'H NMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1, 1,2 tribromoethane, ethyl acetate, toluene and acetophenones, Problems pertaining to the structure elucidation of simple organic compounds using $^1$H NMR spectroscopy techniques.

**UNIT-IV**

**Natural Product:**

Alkaloids- Natural occurrence, General structural features, Isolation and their physiological action, Hoffmann's exhaustive methylation, Emde's modification, Structure elucidation and synthesis of Hygrine and Nicotine, Medicinal importance of Nicotine, Hygrine, Quinine, Morphine, Cocaine, and Reserpine.

Steroids- Introduction, occurrence, importance of steroids, physiological action, stereochemistry and structure determination of cholesterol, Structure and semi synthesis of estrogen, testosterone and progesterone.

Terpenes- Occurrence, classification, isoprene rule, Elucidation of structure and synthesis of Citral, Neral and α-terpineol.

**Suggested Readings:**


- Kalsi, P. S. Textbook of Organic Chemistry 1st Ed., New Age International (P) Ltd. Pub.
- Kemp, W. Organic Spectroscopy, Palgrave.
- Pavia, D. L. et al. Introduction to Spectroscopy 5th Ed. Cengage Learning India Ed.(2015).
- Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley(India) Pvt. Ltd. (Pearson Education).
- Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Graham Solomons, T.W. Organic Chemistry, John Wiley & Sons, Inc. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.

- Clayden, J.; Greeves, N.; Warren, S.; Wothers, P.; Organic Chemistry, Oxford University Press.
- Singh, J.; Ali, S.M., Singh, J. Natural Product Chemistry, Prajati Prakashan (2010).
- G.L. Patrick: Introduction to *Medicinal Chemistry*, *Oxford University* Press, UK.
- Hakishan, V.K. Kapoor: *Medicinal and Pharmaceutical Chemistry*, Vallabh Prakashan, Pitampura, New Delhi.
- William O. Foye, Thomas L., Lemke , David A. William: *Principles of Medicinal Chemistry*, B.I. Waverly Pvt. Ltd. New Delhi.


**Practical-V**

**Credit of the Course: 2**

**Syllabus:**

1. **Organic Chemistry**

Two stage preparation: *p*-nitroacetanilide from Aniline and *p*-Bromoacetanilide from Aniline.
Determination of Iodine value of an oil/fat.

1. Separation of two component mixture using water or $NaHCO_3$ solution & identification of the two components. Preparation of one derivative.

2. **Colorimetric analysis**

a) To verify Beer-lambert law for $KMnO_4$/ $CoCl_2$ using colorimetric analysis.
b) Job's Method
c) Mole-ratio Method

3. Potentiometric analysis:
   a) To titrate the given ferrous ammonium sulphate (FAS) solution using $KMnO_4$ as titrant and calculate the redox potential of $Fe^{2+}/Fe^{+3}$ system on hydrogen scale.
   b) To determine the strength of $HCl/CH_3COOH$ by titrating with NaOH solution potentiometrically.

4. **Solvent Extraction**
   a) Separation and estimation of Mg (II) and Zn (II)
5. **Ion Exchange Method**
   a) Separation and estimation of Mg (II) and Zn (II)
6. **Viva-Voce**
7. **Evaluation of record book of experiments performed in semester.**

**DCMA-501: Liner Algebra-II**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |

| | | | |
|---|---|---|---|
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Linear Algebra-II**

**Course Learning Outcomes:** After completion of this course the student will be able to:
i) Compute the adjoint of a linear operator, minimal solutions to systems of linear equations.
ii) Compute inner products and determine orthogonality on vector spaces, including Gram-Schmidt orthogonalization to obtain orthonormal basis.
iii) Understand the definition and properties of Bilinear, Quadratic and Hermitian forms

**UNIT-I**

Dual Spaces and Diagonalizable Operators : Dual spaces, Double dual, Dual basis, Transpose of a linear transformation and its matrix in the dual basis, Annihilators: Eigenvalues, Eigenvectors, Eigenspaces and characteristic polynomial of a linear operator; Diagonalizability, Invariant subspaces and Cayley-Hamilton theorem; The minimal polynomial for a linear operator.

**UNIT-II**

Inner Product Space: Inner product spaces and norms, Orthonormal basis, Gram-Schmidt orthogonalization process, Orthogonal complements, Bessel's inequality.

**UNIT-III**

Adjoint Operators and Their Properties: The adjoint of a linear operator, Least squares approximation, Minimal solutions to systems of linear equations, Normal, Self-adjoint, Unitary and orthogonal operators and their properties.

**UNIT-IV**

Bilinear, Quadratic and Hermitian forms: Bilinear forms and Matrices, Alternating Bilinear forms, Symmetric Bilinear forms, Quadratic forms, Real symmetric bilinear forms, Hermitian forms.

**Recommended Readings:**


- Friedberg, Stephen H., Insel, Arnold J., & Spence, Lawrence E. (2003). Linear Algebra (4th ed.). Prentice-Hall of India Pvt. Ltd. New Delhi.
- Lang, Serge (1987). Linear Algebra (3rd ed.). Springer.
- Hoffman, Kenneth, & Kunze, Ray Alden (1978). Linear Algebra (2nd ed.). Prentice-Hall of India Pvt. Limited. Delhi. Pearson Education India Reprint, 2015.


**DCMA-502: Complex Analysis-I**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.

- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Complex Analysis- I**

**Course Learning Outcomes:** After completion of this course the student will be able to:

- Understand the significance of Functions of a complex variable, differentiability of complex functions leading to the understanding of Cauchy-Riemann equations.
- Understand the role of Cauchy integral theorem and the Cauchy integral formula.

**UNIT-I**

Complex Numbers, Conjugation, Modulus and Argument, Geometric Interpretation of complex numbers, Extended complex plane, Square roots, Rational powers, Topology of complex plane, sequence and series, Stereographic projection. Functions of a complex variable, Univalent functions, Mappings, Limit, Theorems on limit, Limit at infinity.

**UNIT-II**

Sequence and series of functions and convergence, Continuity, Differentiation, Differentation of composite functions, Necessary and sufficient conditions for differentiability, Complex form of Cauchy Riemann equations, Polar form of Cauchy Riemann equations and Laplacian, Consequences of C- R equations, Analytic functions, Harmonic functions, Harmonic Conjugate, Milne-Thomson method.

**UNIT-III**

Antiderivative theorem, Power series, Uniqueness theorem for power series, Exponential function, Mappings by exponential function, Logarithmic function, Mappings by Logarithmic function, Multivalued functions and its branches, Branches and derivatives of logarithms, Identities involving logarithms, Complex exponents, Trigonometric functions, Hyperbolic functions, Inverses of trigonometric and hyperbolic functions.

**UNIT-IV**

Curves in complex plane, Complex line integration, ML-inequality, Interchange of limit and integration, Interchange of summation and integration, Week form of Cauchy theorem, Cauchy Gaursat theorem for triangle, open convex domains and open connected domains, Cauchy's theorem, Simply and multiply connected domains, Cauchy's integral theorem, Cauchy integral formula.

**Recommended Readings:**


- Brown, James Ward, & Churchill, Ruel V. (2014). Complex Variables and Applications (9th ed.). McGraw-Hill Education. New York.
- Zills, Dennis G., & Shanahan, Patrick D. (2003). A First Course in Complex Analysis with Applications. Jones & Bartlett Publishers, Inc.
- Mathews, John H., & Howell, Rusell W. (2012). Complex Analysis for Mathematics and Engineering (6th ed.). Jones & Bartlett Learning. Narosa, Delhi. Indian Edition.

**DCPY-501: Quantum Physics**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes:** Student teachers will be able to:

- Discuss the concepts of de Broglie hypothesis and origin of quantum theory.
- Explain quantum mechanics and Heisenberg's uncertainty principle.
- Apply the Schrodinger equation for solving different quantum mechanical problems.
- Explain the problem of hydrogen atom and probabilistic interpretation.

**UNIT-I**

Origin of the quantum theory: Failure of classical physics to explain the phenomena such as black-body spectrum, photoelectric effect, Ritz combination principle in spectra, stability of an atom, Planck's radiation law, Einstein's explanation of photoelectric effect, Bohr's quantization of angular momentum and its application to hydrogen atom, limitations of Bohr's theory.

Wave-particle duality: de Broglie's hypothesis for matter waves, the concept of wave and group velocities, evidence for diffraction and interference of 'particles', experimental demonstration of matter waves, Consequence of de Broglie's concepts, quantisation in hydrogen atom, energies of a particle in a box.

**UNIT-II**

Heisenberg's Uncertainty Principle: wave packets, Heisenberg's uncertainty relation for p and x, its extension to energy and time, consequence of the uncertainty relation: gamma ray microscope, diffraction at a slit, particle in a box, position of electron in a Bohr orbit.

Quantum Mechanics: Schrodinger's equation, Postulatory basis of quantum mechanics, operators, eigen functions and eigen values, degeneracy, Commutator of two operators, Hamiltonian operator, Hermitian operators, expectation values, transition probabilities.

**UNIT-III**

Applications of quantum mechanics: Particle in a one dimensional and three dimensional box, reflection at a step potential, transmission across a potential barrier, Tunnel effect, finite potential well, harmonic oscillator.

**UNIT-IV**

Angular momentum: Angular momentum operators and their eigenfunctions, electron spin, Stern Gerlach experiment, spin magnetic moment of electron.

Hydrogen atom: natural occurrence of n, l and m quantum numbers, the related physical quantities, comparison with Bohr's theory, Wave functions, Probabilistic interpretation.

**Suggested Readings:**

- Quantum Physics: S. Gasiorowicz.
- Quantum Mechanics: B. H. Bransden and C. J. Joachain.
- Quantum Physics of Atoms, Molecules, Nuclei and Solids: R. M. Eisberg and R. Resnick.
- Quantum Mechanics: V. Devanathan.
- Quantum Mechanics: D. J. Griffiths
- Quantum Mechanics: Concepts and Applications NouredineZettili

**DCPY-502: Statistical Physics**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes:** Student teachers will be able to:

- Discuss relationship between statistics and thermodynamics.
- Explain Grand Partition function of ideal Bose and Fermi gases.
- Distinguish between ideal Bose and Fermi Systems.

- Discuss microcanonical, canonical and grand canonical ensembles.
- Classify phase transitions.

**UNIT-I**

Elementary Probability Theory: Probability distributions, One and many variables, Central limit theorem, Rules for large numbers, Information, entropy and estimation, Calculation of mean and dispersion(as a measure of fluctuation), Random walk and related examples.

**UNIT-II**

Basic concepts of statistical physics and applications: State of a system (microscopic and macroscopic), Phase space, Density of states and Liouville's theorem, Postulates of statistical mechanics, Relation between statistical and thermodynamic parameters, Gibbs paradox. Ensemble theory (Micro-canonical, Canonical and Grand -canonical), Application to classical ideal gas, Harmonic oscillator, Statistical equivalence of three ensembles.

**UNIT-III**

Quantum Statistics: Introduction to density operator, Bose-Einstein and Fermi-Dirac statistics, Maxwell-Boltzmann statistics as a classical limit. Black-body radiation(Planck's formula), Specific heat of solids, Bose-Einstein condensation, Properties of degenerate Fermi Gas, Electrons in metal, Stability of White dwarf stars.

**UNIT-IV**

Phase Transitions: Equilibrium Conditions, Classification of Phase Transitions, Phase Diagram, Clausius-clapeyron Equation, Second-order Phase Transitions, Phase Transition in Ferromagnetic Materials, Liquid Helium, Saha Ionization Formula.

**Suggested Readings:**

- Fundamentals of Statistical and Thermal Physics : F. Reif
- Statistical Mechanics: Patharia R K, (2nd Ed.), Pergaman press
- Statistical Mechanics: Huang K (2nd Ed., 2nd reprint), John Wiley & Sons
- Statistical Mechanics: Landau L.D. and Lifshitz E M, Butteworth-Heinemaun
- Statistical Mechanics: McQuarrie D A, Harper & Ro

**Practical:**

- To study the Gaussian distribution law.
- To study the Poisson's distribution law.
- To determine the value of Plank's constant by photo cell. (Photo electric effect).
- To determine the value of Plank's constant by solar cell.
- Measurement of electronic charge 'e' by Millikan's experiment.
- Study of resistance characteristics of semi-conductor Material using four probe
- Determination of Stefan's constant.

**Suggested Readings:**

- Concept of Quantum Mechanics, Beiser (McGraw Hill)
- Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.
- A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11th Edn, 2011,Kitab Mahal
- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal,1985, Vani Pub

**DCZO-501: Environmental Biology**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc. (at the end of 15th Week).

**Course Learning Outcome:** After successfully completing the course, the students will be able to:

- Engage in field-based research activities to understand well the theoretical aspects taught besides learning techniques for gathering data in the field.
- Solve the environmental problems involving interaction of humans and natural systems at local or global level

**UNIT-I**

a) Environment: - Atmosphere, lithosphere and hydrosphere as habitats and ecological factors.
b) Abiotic factors: Light and Temperature as ecological factors, limiting factors, Liebig's law of minimum and Shelford Law of tolerance
c) Ecosystem: Dynamics of Ecosystem, Ecological Pyramids, Energy flow, Food chain and Food web, Productivity.
d) Biochemical cycle: water, nitrogen and sulphur cycles recycling of organic nutrients.

**UNIT-II**

a) Population: Definition and attributes–density, natality, vital index, age distribution, growth patterns, migration, dispersal, dispersions, carrying capacity.
b) Biotic Community: Definition, Structure, Ecotone, edge effects, habitat and different types of niche, Ecological succession, Infra and Interspecific interaction. All types of animal association.
c) Elementary statistics: Central tendency and Correlation Coefficient.

**UNIT-III**

a) Pollution Types and Causes
b) Air pollution: sources, acid rain, photochemical smog, prevention and control
c) Water pollution, sources, prevention and control, eutrophication.
d) Noise pollution: sources, prevention and control.
e) Soil pollution: sources, prevention and control
f) Thermal pollution.

**UNIT-IV**

a) Green house effect and global warming
b) Depletion of ozone layer.
c) Natural Disaster: Earthquake, Tsunami
d) Natural Resources and conservation – Non Renewable and Renewable
e) Bioaccumulation and Biomagnifications.

**Practical:**

- Measurement of climatic factors (atmospheric, water temperature and relative humidity)
- Measurement of water and soil pH, edaphic factors of soil, Preparation of soil extract, determination of humidity in microhabitat.
- Measurement of pH, Alkalinity, Free Carbon dioxide, Dissolved Oxygen, Chloride content, Salinity, TDS of water, temporary and permanent hardness of water, velocity of current
- Measurement of population density. Numerical problems of population density determination to be done.
- A filed study of any one of the habitats to be assigned to an individual or to a group of students or Projects may be given to the students based on Ecological and Environmental issues.

**Suggested Readings:**


- Basic Ecology, Eugene Pleasants Odum. Saunders College Pub., 1983, 613 pages.
- Fundamentals of Ecology, Eugene Pleasants Odum. Thomson Brooks/Cole, 2005, 598 pages.
- Applied ecology and environmental management, Edward I. Newman. Oxford Blackwell science, 2000.
- Ecology and ecosystem conservation, Oswald J. Schmitz. Washington Island Press, 2007.
- Ecology individuals, populations, and communities, Michael Begon, John L. Harper, Colin R. Townsend. Boston Blackwell Science, 1996.
- Elements of ecology, Robert Leo Smith and Thomas M. Smith. Benjamin Cummings, 2003.
- Essentials of ecology, Colin R. Townsend, Michael Begon, John L. Harper, Blackwell, 2003.
- Metapopulation ecology, lIkka Hanski. Oxford University Press, 1999.
- Environment and Sustainable Development, M.H. Fulekar, Bhawana Pathak, R K Kale. Springer India, 2013, 198 pages.
- Sustainable Development: Environment, Energy and Water Resources, M.K. Ghosh Roy. Ane Books, 2011, 384 pages.
- Global Environmental Issues, Frances Harris. John Wiley & Sons, 2005, 336 pages.
- Changing fauna Ecology in the Thar desert, B.K. Tyagi. Q. H. Baqri. Scientific Publishers 2005, 367 pages.
- Faunal Ecology and Conservation of the Great Indian Desert, C. Sivaperuman, Qaiser H. Baqri, G. Ramaswamy, M Naseema. Springer Science & Business Media, 2008, 222 pages.
- Thar Desert in Retrospect and Prospect, R.P. Dhir, D.C.K. Joshi and S. Kathju. Scientific publisher, 2018.
- Thar Desert in Rajasthan: Land, men and Environment, R. P. Dhir, A. K. Singhvi, Amal Kar. Geological survey of India, 1992.
- An Advanced Textbook On Biodiversity Principles And Practice, Krishnamurty. Oxford and IBH Publishing, 2004, 276 pages.
- Biogeography: Introduction to Space, Time, and Life, Glen MacDonald. Wiley, 2017,518 pages.
- Basic Biogeography, N. V. Pears. Taylor & Francis, 2017, 358 pages.
- Fundamentals of Eco toxicology: The Science of Pollution, Fourth Edition, Michael C. Newman. CRC Press, 2014, 680 pages.
- Environmental Law and Policy in India, Shyam Divan, Amin Rosencranz. Oxford University Press India, 2002, 876 pages.
- Climate Change Policy: A Survey, Stephen H. Schneider, Amin Rosencranz, John O. Niles. Island Press, 2002, 584 pages.
- Handbook of Environmental Health, Fourth Edition, Two Volume, Herman Koren, Michael S. Bisesi. CRC Press LLC, 2018, 1722 pages

**DCZO-502: Instrumentation and Biostatistics**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc. (at the end of 15th Week).

**Course Learning Outcome:** After successfully completing the course, the students will be able to:

- Know the purpose of the technique, its proper use and possible modifications/ improvement.
- Learn the theoretical basis of technique, its principle of working and its correct application., construction repair and adjustment of any equipment required for a technique.
- Learn the maintenance laboratory equipments/ tools, safety hazards and precautions.
- Demonstrate knowledge and practical skills of using instruments in biology and medical field.
- perform techniques involved in molecular biology and diagnosis of diseases
- appreciate the basic idea about the Biostatics, Data Collection, Data compilations and Data representation in the form of Table, Graph and figures.
- Learn the data interpretations for the sake of objective based analysis etc.

**UNIT-I**

a) Microscopy: Principles and handling of Light microscopy, Dark field microscopy, Phase contrast microscopy, Fluorescence microscopy, Confocal microscopy and Electron microscopy (SEM and TEM).
b) pH meter, measurement of pH.

**UNIT-II**

Biochemical techniques: Centrifugation and Chromatography

a) Centrifugation: Principles, types and applications. (High speed and Ultracentrifugation)
b) Chromatography: Principle and applications of TLC and HPLC and GC

**UNIT-III**

Molecular Techniques:

a) Principle of Agarose gel-electrophoresis, SDS-PAGE, DNA Sequencing (Sanger's Dideoxy method),

b) PCR, DNA Fingerprinting, ELISA, Southern Blotting and Western Blotting

**UNIT-IV**

a) Elementary idea of Computer Fundamentals (MS Word, Excel and Power Point Presentation);
b) Frequency Distribution; Graphical Presentation of Data (line diagram, Histogram, Bar diagram and Pie diagram);
c) Measures of central tendency and dispersal; probability distributions (Binomial, Poisson and normal);
d) Sampling distribution; Difference between parametric and non-parametric statistics; Confidence Interval; Errors; Levels of significance; Correlation; t-test; $X^2$ test

**Practical:**

- Microscopy – Light microscopy: principles, parts & function
- Micrometry- principle and measurement of microscopic objects: Low power and high power.
- Camera Lucida drawing with magnification and scale.
- Principle and working of phase contrast microscope
- Principle & operation of Centrifuge
- Preparation of standard acid and alkali and their standardization. b) Preparation of various solutions (normal, molar, and percent) and ppm/ppb by serial dilutions
- Study of principle and working of pH meter and Measurement of pH of Milk, Pepsi, Lemon juice etc. using pH paper and pH meter
- Study of principle of Chromatography and separation of amino acids mixture By ascending Paper Chromatography
- Principle & operation of Colorimeter
- Principle & operation of Spectrophotometer
- Principle and technique of TLC (demonstration), TLC separation of Amino acids from purified samples and biological materials (demonstration)
- Study visit to an institute /laboratory
- Diagrammatic representation of data.
- Problems based on construction of frequency distributions, cumulative frequency distributions and their graphical representations, stem and leaf plot.
- Problems based on measures of central tendency
- Problems based on analysis of categorical data

**Suggested Readings:**


- Goon, A.M., Gupta, M.K. and Dasgupta, B. (2002): Fundamentals of Statistics, Vol. I& II, 8th Edn. The World Press, Kolkata.
- Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
- Mood, A.M., Graybill, F.A. andBoes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn. (Reprint), Tata McGraw-Hill Pub. Co. Ltd.
- Tukey, J.W.(1977) : Exploratory Data Analysis, Addison-Wesley Publishing Co.
- Agresti, A. (2010): Analysis of Ordinal Categorical Data, 2nd Edition, Wiley. Freedman, D., Pisani, R. and Purves, R. (2014): Statistics, 4th Edition, W. W. Norton & Company.


**DECB-501: Herbal Medicines and Human Health**

| | |
|---|---|
| Credits: 2L+1T+0P | Marks 75 |
| Contact hours per week: 4 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.

- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |
| **Total Marks** | 75 | | 30 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –

- Appreciate the significance of Indian Herbal medicine.
- Identify the Indian medicinal plants.
- Explain the medicinal value of plants to treat human diseases.
- Conserve important Indian medicinal plants.

**UNIT:I**

Scope and importance of medicinal plants in the traditional systems Indian and modern medicines.
Importance of preventive and holistic healing in the Indian traditional medicine.
Ayurveda: history, origin, fundamental doctrine and concept of Panchabhutas, saptadhatus, tridosasin reacrtion to health and diseases.

**UNIT:II**

Therapeutic and pharmaceutical uses of important plants used in the ayurveda, sidha unani system of medicine,
Plants used by the tribals-
a-Food plants
b- Intoxicants and beverages
c- Resins, oils and miscellaneous uses
Medico-ethnobotanical sources in India, significance of the following:
*Azadirachta indica, Ocimum sanctum, Pongamia pinnata, Cassia auriculata, Indigofera tinctoria, Prosopis cineraria, Acacia nilotica, Ficus religiosa*

**UNIT:III**

Nutraseuticals and polyhedral formulations. Plants used for the treatment of the haepatic disorder, cardiac disorders, infertility, diabetes, blood pressure, cancer and skin diseases. Role of AYUSH, NMPB, and AIIA in the promotion of medicinal plants. Evaluation and standardization of crud drugs. Fundamentals of pharmacgonosy. Organoleptic, microscopic and phytochemicals evaluation of drugs.

**UNIT:IV**

**Conservation of** Endangered and endemic medicinal plants Red Dala list Criteria. In situ conservation: Biosphere reserves, National parks. Ex-situ conservation: botanical gardens, national gene banks, plant cell, tissue and organ culture, Cryopreservation, Role of NBPGR, CIMAP

**Suggested readings:**

- Rao, A.P. Herbs that heal. Diamond Pocket Books (P) Ltd., New Delhi, 1999
- Pharmacognosy, S.B.Gokhale, Dr.C.K. Kokate, A.P. Purohit, Publisher: Nirali Prakasham, Pune, 2002
- Herbs that Heal, Acharya Vipul Rao – Diamond Pocket Books, New Delhi, 2005
- Practical Pharmacognosy. Dr.C.K. Kokate et al. 2003
- An Introduction to Medicinal Botany and Pharmacognosy – N.C. Kumar,
- Emkay Publications, New Delhi, 2004.
- Ethnobiology – R.K.Sinha & Shweta Sinha. Surabhe Publications – Jaipur. 2001
- Contribution to Indian ethnobotany – S.K. Jain, 3rd edition, scientific publishers, B.No. 91, Jodhpur, India. 2001

**PRACTICALS**

**Course Content:**

- Study of some important medicinal plants
- Study of some important nutraceutical plants
- Field visit of reputed Indian Institute of Herbal medicine
- Identification and collection of important medicinal, nutraceutical and ethnobotanical plants
- Study of bio-geographical regions of India important for origin and cultivation medicinal, nutraceutical and ethno botanical plants

## DECC-501 A: Research Methodology for Chemistry

| | |
|---|---|
| Credits: 2L+1T+0P | Marks 75 |
| Contact hours per week: 4 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |
| **Total Marks** | 75 | | 30 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes:** By the end of this course, students will be able to –

1. Gain a deep understanding of the fundamental principles and concepts that underlie scientific research in the field of chemistry.

2. Learn to design and develop research projects, including formulating research questions, hypotheses, and experimental methodologies specific to chemistry.
3. Acquire proficiency in data collection, analysis, and interpretation techniques, using appropriate statistical tools and software for chemistry research.
4. Improve practical laboratory skills, including safety measures, equipment operation, and experimental procedures commonly used in chemistry research.
5. Develop the ability to critically evaluate scientific literature and integrate relevant research findings into your own work.
6. Learn to communicate research findings effectively through written reports, presentations, and scientific posters tailored to the chemistry research community.

**UNIT-I**

Literature Survey:

Print: Sources of information: Primary, secondary, tertiary sources, Journals: Journal abbreviations, abstracts, current titles, reviews, monographs, dictionaries, text-books, current contents, Introduction to Chemical Abstracts and Beilstein, Subject Index, Substance Index, Author Index, Formula Index, and other Indices with examples

Digital: Web resources, E-journals, Journal access, TOC alerts, Hot articles, Citation index, Impact factor, H-index, E-consortium, UGC infonet, E-books, Internet discussion groups and communities, Blogs, Preprint servers, Search engines, Scirus, Google Scholar, ChemIndustry, Wiki- Databases, ChemSpider, Science Direct, SciFinder, Scopus

Information Technology and Library Resources: The Internet and World Wide Web, Internet resources for chemistry, Finding and citing published information.

**UNIT-II**

Methods of Scientific Research and Writing Scientific Papers:

Reporting practical and project work, Writing literature surveys and reviews, organizing a poster display, giving an oral presentation, Writing scientific papers – justification for scientific contributions, bibliography, description of methods, conclusions, the need for illustration, style, publications of scientific work, Writing ethics, Avoiding plagiarism.

**UNIT-III**

Chemical Safety and Ethical Handling of Chemicals:

Safe working procedure and protective environment, protective apparel, emergency procedure and first aid, laboratory ventilation, Safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmospheric – safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals, procedure for laboratory disposal of explosives, identification, verification and segregation of laboratory waste, disposal of chemicals in the sanitary sewer system, incineration and transportation of hazardous chemicals.

**UNIT-IV**

Data Analysis

The Investigative Approach: Making and Recording Measurements, SI Units and their use.Scientific method and design of experiments, Analysis and Presentation of Data: Descriptive statistics, Choosing and using statistical tests, Chemometrics. Analysis of variance (ANOVA), Correlation and regression, Curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals, General polynomial fitting, linearizing transformations, exponential function fit, *r* and its abuse, Basic aspects of multiple linear regression analysis.

**Suggested Readings:**


- Dean, J. R., Jones, A. M., Holmes, D., Reed, R., Weyers, J. & Jones, A. (2011) Practical skills in chemistry. 2nd Ed. Prentice-Hall, Harlow.
- Hibbert, D. B. & Gooding, J. J. (2006) Data analysis for chemistry. Oxford University Press.
- Topping, J. (1984) Errors of observation and their treatment. Fourth Ed., Chapman Hall, London.
- Harris, D. C. Quantitative chemical analysis. 6th Ed., Freeman (2007) Chapters 3-5.
- Levie, R. de, How to use Excel in analytical chemistry and in general scientific data analysis. Cambridge Univ. Press (2001) 487 pages.
- Chemical safety matters – IUPAC – IPCS, Cambridge University Press, 1992.

- OSU safety manual 1

**DECC-501 B: Industry and Environment**

| | |
|---|---|
| Credits: 2L+1T+0P | Marks 75 |
| Contact hours per week: 4 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |
| **Total Marks** | 75 | | 30 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

Course Learning Outcomes: By the end of this course, students will be able to –

- Gain a comprehensive understanding of industrial chemical processes and their impact on the environment.
- Learn how to navigate and adhere to environmental regulations and sustainability standards relevant to industrial chemical production.
- Develop the ability to assess the potential toxicity and risks associated with industrial chemicals and their release into the environment.
- Explore the principles of green chemistry and how they can be applied to reduce the environmental footprint of industrial chemical processes.
- Acquire knowledge and skills to implement pollution prevention strategies in industrial settings, minimizing adverse environmental effects.
- Identify and evaluate sustainable alternatives and technologies for industrial chemicals, aiming to promote environmental stewardship in the industry.

**UNIT-I**

Industrial Gases and Inorganic Chemicals

Industrial Gases: Large scale production uses storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene. Inorganic Chemicals: Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.

**UNIT-II**

Industrial Metallurgy

Preparation of metals (ferrous and nonferrous) and ultrapure metals for semiconductor technology
Environment and its segments
Ecosystems, Biogeochemical cycles of carbon, nitrogen and sulphur, Air Pollution: Major regions of atmosphere, Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry, Environmental effects of ozone, Major sources of air pollution, Pollution by $SO_2$, $CO_2$, CO, $NO_x$, $H_2S$ and other foul smelling gases, Methods of estimation of CO, $NO_x$, $SO_x$ and control procedures, Effects of air pollution on living organisms and vegetation, Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal, Control of particulates.

**UNIT-III**

Water Pollution: Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems, Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer, etc.
Sludge disposal, Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis, ion exchange), Water quality parameters for waste water, industrial water and domestic water.
Energy & Environment

**UNIT-IV**

Sources of energy: Coal, petrol and natural gas, Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc. Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.
Biocatalysis
Introduction to biocatalysis: Importance in ―Green Chemistry‖ and Chemical Industry.

**Suggested Readings:**


- E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.
- R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.
- J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
- S. S. Dara: A Textbook of Engineering Chemistry, S. Chand & Company Ltd. New Delhi.
- K. De, Environmental Chemistry: New Age International Pvt., Ltd, New Delhi.
- S. M. Khopkar, Environmental Pollution Analysis: Wiley Eastern Ltd, New Delhi.
- S.E. Manahan, Environmental Chemistry, CRC Press (2005).
- G.T. Miller, Environmental Science 11th edition. Brooks/ Cole (2006).
- A. Mishra, Environmental Studies. Selective and Scientific Books, New Delhi, 2005.


**DECM-501 A: Mechanics**

| | |
|---|---|
| Credits: 2L+1T+0P | Marks 75 |
| Contact hours per week: 4 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.

- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| Distribution Marks for the course | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |
| **Total Marks** | 75 | | 30 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Mechanics (Elective-I)**

**Course Learning Outcomes:** After completion of this course the student will be able to:

- Compute velocities and accelerations along radial, transverse directions and along tangential, normal directions.
- Solve Hooke's law related problems on horizontal and vertical elastic strings.
- Understand the concept of Constrained motion, circular and Cycloidal motion.

**UNIT-I**

Analytical conditions of equilibrium of coplanar forces, Virtual Work, Catenary, Center of Gravity.

**UNIT-II**

Velocities and accelerations along radial, transverse directions and along tangential, normal directions. Simple Harmonic Motion, Rectilinear motion under variable laws.

**UNIT-III**

Motion in resisting medium, Hooke's law related problems on horizontal and vertical elastic strings.

**UNIT-IV**

Impact, Direct and oblique, Central forces, Central orbits, p-r equation, Constrained motion, circular and Cycloidal motion.

**Recommended Readings:**

- Elementary Mechanics: D.C. Gokhroo and S.L. Bhargava, JPH, 2002.
- The elements of Statics & Dynamics, Part-I Statics: S.L. Loney, Cambridge University Press, Cambridge, $5^{th}$ ed., 1954.
- An Elementary Treatise on the Dynamics of a Particle and of Rigid Bodies, Metric Edition: S.L. Loney, Surjeet Publication, New Delhi, 1988.
- Elements of Dynamics: D.C. Gokhroo, S.R. Saini, & R.K. Arora, JPH, 1998.
- Dynamics: Y.N.Gaur, A.K. Mathur, & M.C. Goyal, Ramesh Book Depot, Jaipur-New Delhi, 2008-09.
- Elements of Statics: K.C. Sharma, D.C. Gokhroo, & S.R. Saini, JPH, 1996.

**DECM-501 B: Probability and Statistics**

| | |
|---|---|
| Credits: 2L+1T+0P | Marks 75 |
| Contact hours per week: 4 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.

- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |
| **Total Marks** | 75 | | 30 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Probability and Statistics (Elective-I)**

**Course Learning Outcomes:** After completion of this course the student will be able to:

i) Measure the central tendency: Arithmetic mean, Geometric mean, Harmonic mean, Mode, Median.
ii) Understand the concept of Poisson distribution, Binomial distribution, Normal distribution.
iii) Establish a formulation helping to predict one variable in terms of the other, i.e., correlation and linear regression.

**UNIT-I**

Measures of central tendency: Arithmetic mean, Geometric mean, Harmonic mean, Mode, Median, usage of these measures in daily life, descriptive statistics, measures of dispersion: range, standard deviation, variance, coefficient of variance, skewness, kurtosis.

**UNIT-II**

Sample space, Probability set function, Conditional Probability, Theoretical Probability, Subjective Probability, addition and multiplication theorems of Probability, Cumulative distribution function, Probability mass/density functions, Baye's Theorem, Real random variables - Discrete and continuous.

**UNIT-III**

Mathematical expectation, Moments, Moment generating function, Characteristic function, Probability distributions: Binomial distribution: mean and variance of binominal distribution; Uniform distribution, Poisson distribution; poisson process, mean and variance of poisson distribution, Normal distribution.

**UNIT-IV**

Correlation, Correlation coefficient, Covariance, Independent random variables, Regression and Line of regression, Linear regression for two variables, The method of least squares.

**Recommended Readings:**


- Sheldon R.M., 2010, Introductory Statistics, Academic Press.
- Rohatgi V.K. and Md. Ehsanes Saleh A.K., 2015, An Introduction to Probability and Statistics (3rd Ed.), John Wiley & Sons.
- Dharmaraja S. and Das D., 2018, Introduction to Statistical Methods, Design of Experiments and Statistical Quality Control, Springer.

- Mayer P. L., 1970, Introductory Probability and Statistical Applications, Addison-Wesley.


## DECP-501 A: Laser and Fiber Optics

| | |
|---|---|
| Credits: 2L+1T+0P | Marks 75 |
| Contact hours per week: 4 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |
| **Total Marks** | 75 | | 30 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes:** Student teachers will be able to:

- Discuss the Characteristics of laser light.
- Explain absorption, spontaneous and stimulated emission of radiation.
- Explain working principle and applications of Ruby, He-Ne and semiconductor lasers.
- Explain the salient features of optical fibers.
- Discuss Waveguides and optical fiber modes.

### UNIT-I

Lasers: Characteristics of laser light, directionality, intensity, monochromaticity, spatial and temporal coherence, interaction of radiation with matter. Spontaneous and Stimulated emission and Absorption processes and their transition rates. Optical amplification, Population inversion, Basic concepts of two, three and four energy level systems, optical resonator, characteristics of semiconductor lasers, Ruby laser, He-Ne/ $CO_2$-$N_2$ laser.

### UNIT-II

Optical Fibers: Introduction, need for optical communication, salient features of optical fibers, ray theory of light guidance, numerical aperture, modes of a fiber, single and multimode fibers, step-index and graded-index fibers, fiber fabrication techniques.

Transmission characteristics of optical fibers, attenuation, pulse broadening mechanism, intermodal dispersion, bit rate -length product, material dispersion, electromagnetic wave analysis of light propagation in an infinitely extended medium, em waves in dielectrics, boundary conditions.

**UNIT-III**

Waveguides: Electromagnetic analysis of planar optical waveguides, TE and TM modes, planar mirror waveguide, dielectric symmetric step-index, planar waveguide, symmetric and anti-symmetric modes, b-V curves, modal fields.

**UNIT-IV**

Power associated with modes of dielectric symmetric planar waveguide, asymmetric planar waveguide, single polarization,single mode waveguide, excitation of guided modes by prism coupling technique, radiation modes, optical fiber waveguide, EH and HE modes, weakly guiding fibers, LP modes, mode cut-offs, b-v curves.

Optical fiber modes, field patterns, degeneracies, fractional power in the core, single mode fiber, cut-off wavelength, mode field diameter, bend loss, splice loss, waveguide dispersion, group delay.

Total chromatic dispersion, pulse broadening and chirping, dispersion in graded-index and multilayer fibers, optical fiber components and devices, directional coupler, power splitter, WDM coupler, polarization controllers, fiber Bragg gratings.

**Project**:

- To measure the numerical aperture of an optical fibre
- To measure the near field intensity profile of a fibre and study its refractive index profile
- To study the variation of the bending loss in a multimode fibre
- To determine the power loss at a splice between two multimode fibre
- To determine the mode field diameter (MFD) of fundamental mode in a singlemodefibre by measurements of its far field Gaussian pattern.

**Suggested Readings:**


- "Introduction to Fiber Optics", Ghatak A K and Thyagarajan K, Cambridge University Press.
- "Fundamentals of Photonics," Saleh B E A and Teich M C, Wiley-Interscience.
- "Optical Fiber Communication System,"Agrawal G P, Wiley-Interscience.
- "Optical Fiber Communications", Keiser G, McGraw Hill.
- "Optical Waveguide Theory", Snyder A and Love J, Chapmann and Hall.
- "Optical Fiber Communications,"Senior J M, Pearson Prentice Hall


**DECP-501 B: Renewable Energy Sources**

| | |
|---|---|
| Credits: 2L+1T+0P | Marks 75 |
| Contact hours per week: 4 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |

| | | | |
|---|---|---|---|
| **Total Marks** | 75 | | 30 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes:** The student teachers will be able to:

- Discuss renewable energy systems and their effective tapping technologies.
- Estimate the amount of energy in different types of renewable energy systems.
- Explain the feasibility of different types of energy sources.
- Discuss different types of energy and explain their significance in daily life.

**UNIT-I**

Solar Energy:
Sun as Source of Energy, Availability of Solar Energy, Nature of Solar Energy, Solar Energy and Environment, Various Methods of using solar energy –Photothermal, Photo voltaic, Photosynthesis, Present and Future Scope of Solar energy, Hybrid wind energy systems- wind and diesel power, wind and conventional grid, wind and Photo voltaic systemes

**UNIT-II**

WindEnergy: Basics & Power Analysis, Wind resource assessment, Power Conversion Technologies and applications, Wind Power estimation techniques, Principles of Aerodynamics of wind turbine blade, Various aspects of wind turbine design, Wind Turbine Generators: Induction, Synchronous machine, constant and Fgenerations, variable and Fgenerations, Reactive power compensation. Site Selection, Concept of wind form & project cycle, Cost economics & viability of wind farm.

**UNIT-III**

Geothermal, Tide and Wave Energy : Availability of Geothermal Energy-size and distribution, Recovery of Geothermal Energy, Various Types of Systems to use Geothermal Energy, Direct heat applications, Power Generation using Geothermal Heat, Sustainability of Geothermal Source, Status of Geothermal Technology, Economics of Geothermal Energy.

**UNIT-IV**

Hydrogen Production: Direct electrolysis of water, thermal decomposition of water, biological and biochemical methods of hydrogen production.
Hydrogen Energy: Hydrogen as are new able energy source, Sources of Hydrogen, Fuel for Vehicles.
Nuclear Energy**:** Potential of Nuclear Energy, International Nuclear Energy Policies and Regulations. Nuclear Energy Technologies Fuel enrichment, Different Types of Nuclear Reactors, Nuclear Waste Disposal, and Nuclear Fusion

**Project:**

- Examining the benefits of using solar energy and its role in addressing the global threat of climate change.
- Assessing the impact of solar energy on agricultural sustainability practices in India
- Investigating the economic benefits of increasing biomass conversion – a case study of the renewable energy industry
- The cost of solar energy versus other renewable energy sources
    - Why is it more important than ever to prioritise renewable energy?

**Suggested Readings:**


- Wind energy Conversion SystemsL LFreris, (Prentice Hall, 1990).
- Wind Turbine Technology: Fundamental concepts of wind turbine technology, D A Spera, (ASME Press, NY, 1994).
- Wind Energy Systems, G L Johnson (PrenticeHall, 1985).
- Wind Energy Explained J F Manwell, J G McGowan and A. L Rogers, (John Wiley & Sons Ltd., 2010).

- Renewable Sources of Energy and Conversion Systems,N K Bansal, et al., (Tata McGraw-Hill, 1990).
- Solar Energy Handbook, Kreith and Kreider, (McGraw Hill, 1982).
- SolarCells, M A Green, (Prentice Hall, 1981).
- Solar Hydrogen Energy Systems, T Ohta (Pergamon Press, 1979)
- HydrogenTechnologyforEnergy, D Methis, (Knowledge

**DECZ-501 A: Elementary Fish Biology**

| | |
|---|---|
| Credits: 2L+1T+0P | Marks 75 |
| Contact hours per week: 4 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |
| **Total Marks** | 75 | | 30 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:**

- Gain an overview of integrative taxonomy of cultured aquatic organisms.
- Understand the anatomy and physiology of cultured aquatic organisms
- Understand the reproductive biology of cultured organisms for critical evaluation and possible manipulation.
- Develop necessary understanding in fish biology for performing technical responsibilities as an entrepreneur/ manager/ consultant / administrator/ extension worker.

**UNIT-I**

a) Introduction and Classification: General description of fish; Account of systematic classification of fishes (upto classes); Classification based on feeding habit, habitat and manner of reproduction.

**UNIT-II**

a) Morphology and Physiology: Types of fins and their modifications; Locomotion in fishes; Hydrodynamics;
b) Types of Scales, Use of scales in Classification and determination of age of fish; Gills and gas exchange; Swim Bladder: Types and role in Respiration, buoyancy; Osmoregulation in Elasmobranchs;
c) Reproductive strategies (special reference to Indian fishes); Electric organs; Bioluminiscience; Mechanoreceptors; Schooling; Parental care; Migration.

**UNIT-III**

a) Fisheries: Inland Fisheries; Marine Fisheries; Environmental factors influencing the seasonal variations in fish catches in the Arabian Sea and the Bay of Bengal; Fishing crafts and Gears; Depletion of fisheries resources; Application of remote sensing and GIS in fisheries; Fisheries law and regulations
b) Fish in research: Transgenic fish, Zebrafish as a model organism in research

**UNIT-IV**

a) Aquaculture: Sustainable Aquaculture; Extensive, semi-intensive and intensive culture of fish; Pen and cage culture; Polyculture; Composite fish culture;
b) Brood stock management; Induced breeding of fish; Management of finfish hatcheries; Preparation and maintenance of fish aquarium; Preparation of compound diets for fish;
c) Role of water quality in aquaculture; Fish diseases: Bacterial, viral and parasitic; Preservation and processing of harvested fish, Fishery by-products.

**Practical:**

- Study of *Petromyzon*, *Myxine*, *Pristis*, *Chimaera*, *Exocoetus*, *Hippocampus*, *Gambusia*, *Labeo*, *Heteropneustes*, *Anabas*
- Study of different types of scales (through permanent slides/ photographs).
- Study of crafts and gears used in Fisheries
- Water quality criteria for Aquaculture: Assessment of pH, conductivity, Total solids, Total dissolved solids
- Study of air breathing organs in *Channa*, *Heteropneustes*, *Anabas* and *Clarias*
- Demonstration of induced breeding in Fishes (video)
- Demonstration of parental care in fishes (video)
- Project Report on a visit to any fish farm/ pisciculture unit/Zebrafish rearing Lab.

**Suggested Readings:**


- Q Bone and R Moore, Biology of Fishes, Talyor and Francis Group, CRC Press, U.K.
- D. H. Evans and J. D. Claiborne, The Physiology of Fishes, Taylor and Francis Group, CRC Press, UK von der Emde, R.J. Mogdans and B.G. Kapoor. The Senses of Fish: Adaptations for the Reception of Natural Stimuli, Springer, Netherlands
- C.B.L. Srivastava, Fish Biology, Narendra Publishing House
- J.R. Norman, A history of Fishes, Hill and Wang Publishers
- S.S. Khanna and H.R. Singh, A text book of Fish Biology and Fisheries, Narendra Publishing House


**DECZ-501 B: Wildlife Conservation and Management**

| | |
|---|---|
| Credits: 2L+1T+0P | Marks 75 |
| Contact hours per week: 4 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| Distribution Marks for the course | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |
| **Total Marks** | 75 | | 30 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:**

- Develop an understanding of how animals interact with each other and their natural environment
- Develop the ability to use the fundamental principles of wildlife ecology to solve· local, regional and national conservation and management issues.
- Develop the ability to work collaboratively on team-based projects·
- Demonstrate proficiency in the writing, speaking, and critical thinking skills needed· to become a wildlifetechnician Gain an appreciation for the modern scope of scientific inquiry in the field of

**UNIT-I**

a) Introduction to conservation biology, values of biodiversity and conservation ethics. Patterns and process of biodiversity, losses and threats to biodiversity.
b) Significance of ecological restoration in conservation. Duties of the central and the State Government, Biodiversity management committees.
c) Introduction to Wild Life Management, Values, ethics and importance of Wildlife Management.
d) Habitat Analysis: Evaluation and Management of Wildlife: Physical and Biological Parameters; Standard Evaluation Procedures: Faecal analysis of ungulates and carnivores: Faecal samples, slide preparation, Hair identification, Pug marks and census method.

**UNIT-II**

a) Red Data Book and its significance. Role of NGOs in conservation, International NGOs; UNEP, GEF, WCS, Bird Life International, Important NGOs in India& their contributions WWF, ATREE, BNHS, WTI, Kalpavriksha etc.
b) Various Environmental movements in India: Bishnoi Movement, Chipko Movement, Narmada Bachao Andolan, Silent Valley Movement, Baliyapal Movement.

**UNIT-III**

a) Counting Methods or Population assessment (Total Count, Road Side Count, Waterhole Count, Nest Count, Camera trap Methods, Pugmark Census, Call Census, Radio tagging, Line transect, Quadrate Method, Mark-Recapture), Sampling techniques and strategies (random, stratified and systematic).
b) Concept of species richness, evenness and diversity and their measures, Diversity indices.
c) Geographical Information System (GIS), Global Positioning System (GPS), and Remote Sensing (RS).
d) Human-wildlife Conflict: Poaching, illegal trading, conflict management and shifting from extraction to preservation; effect of extinction of a species on ecosystem; Forest landscape restoration

**UNIT-IV**

a) Wildlife Protection Act, Biodiversity Act, Forest Act and other Rules and Acts for Biodiversity protection and conservation.
b) Management of excess Population and Translocation: Bio- telemetry; Common diseases of wild animal; Quarantine; Population Viability and Habitat Analysis (PVHA), captive breeding and propagation, rescue, rehabilitation and reintroduction, gene banks, ex-situ and in-situ conservation.
c) Sustainable Wildlife Management: Eco tourism / Wildlife tourism in forests;

**Practical:**

- Identification of mammalian fauna, avian fauna, herpeto-fauna

- Identification of Venomous and Non venomous snakes
- Demonstration of basic equipment needed in biodiversity studies use, care and maintenance (Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of Cameras and lenses)
- Familiarization and study of animal evidences in the field; Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers etc.
- Demonstration of different field techniques for flora and fauna. Trail / transect monitoring for abundance and diversity estimation of mammals and bird (direct and indirect evidences)
- Visits to nearby Zoo, Museum, Forest, sea-shore, Nursery, Aquaria or any other relevant site must be arranged. The report of these visits will be submitted as part of the Practical work.

**Suggested Readings:**


- Caughley, G., and Sinclair, A.R.E. (1994). Wildlife Ecology and Management. Blackwell Science.
- Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). People and Wildlife, Conflict or Coexistence? Cambridge University.
- Bookhout, T.A. (1996). Research and Management Techniques for Wildlife and Habitats, 5th edition. The Wildlife Society, Allen Press.
- Sutherland, W.J. (2000). The Conservation Handbook: Research, Management and Policy. Blackwell Sciences
- Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008). Problem-Solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory. Blackwell Publishing.


**INDC-501 A - SWAYAM / NPTEL / MOOC**

One Inter Disciplinary Course from available list of MOOCs; students will have to opt as per notification.

| Paper Code | Name of the Paper | Credits | Periods per Week | Number of Lectures |
|---|---|---|---|---|
| INDC-501 A | SWAYAM / NPTEL / MOOC | 2 | 1+1+0 | |

| **Inter Disciplinary Course II: SWAYAM / NPTEL / MOOC** | **Credit: 2** |
|---|---|
| **Course Learning Outcome:** After successfully completing the course, the students will be able to:<br>• About the various courses offered by Online Portals<br>• Students will be able to access the courses offered by international institutes in concerned subjects. | |

**INDC-501 B: Intellectual Property Rights**

| | |
|---|---|
| Credits: 1L+1T+0P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| Distribution Marks for the course | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of the course, students will be able:

1. Understand the various forms of intellectual property, including patents, trademarks, copyrights, and trade secrets, and be able to differentiate between them.
2. Comprehend the legal framework surrounding intellectual property rights, including national and international laws, treaties, and agreements.
3. Demonstrate the ability to navigate the processes of acquiring and protecting intellectual property rights, such as filing for patents, trademarks, and copyrights.
4. Analyze and address cases of IP infringement, and understand the mechanisms and strategies for enforcing intellectual property rights.
5. Evaluate strategies for monetizing intellectual property, including licensing, technology transfer, and branding, and identify potential risks and benefits.
6. Recognize the ethical and societal implications of intellectual property rights, including issues related to innovation, access to knowledge, and the public domain.

**UNIT-I**

Introduction to Intellectual Property: Historical Perspective, Different Types of IP, Importance of protecting IP. Copyrights: Introduction, How to obtain, Differences from Patents. Trade Marks Introduction, How to obtain, Different types of marks – Collective marks, certification marks, service marks, Trade names, etc, Differences from Designs. Patents: Historical Perspective, Basic and associated right, WIPO, PCT system, Traditional Knowledge, Patents and Healthcare – balancing promoting innovation with public health, Software patents and their importance for India.

**UNIT-II**

Geographical Indications: Definition, rules for registration, prevention of illegal exploitation, importance to India. Industrial Designs: Definition, How to obtain, features, International design registration, Layout design of integrated circuits Circuit Boards, Integrated Chips, Importance for electronic industry. Trade Secrets: Introduction and Historical Perspectives, Scope of Protection, Risks involved and legal aspects of Trade Secret Protection.

**UNIT-III**

Different International agreements (a) Word Trade Organization (WTO): (i)General Agreement on Tariffs & Trade (GATT), Trade Related Intellectual Property Rights (TRIPS) agreement (ii)General Agreement on Trade related Services (GATS) (iii)Madrid Protocol (iv)Berne Convention (v)Budapest Treaty (b) Paris Convention WIPO and TRIPS, IPR and Plant Breeders Rights, IPR and Biodiversity IP Infringement issue and enforcement – Role of Judiciary, Role of law enforcement agencies – Police, Customs etc. Economic Value of Intellectual Property – Intangible assets and their valuation, Intellectual Property in the Indian
Context – Various laws in India Licensing and technology transfer.

**Suggested Readings:**


- N.K. Acharya: Textbook on intellectual property rights, Asia Law House (2001).
- Manjula Guru & M.B. Rao, Understanding Trips: Managing Knowledge in Developing Countries, Sage Publications (2003).
- P. Ganguli, Intellectual Property Rights: Unleashing the Knowledge Economy, TataMcGrawHill (2001).

- Arthur Raphael Miller, Micheal H.Davis; Intellectual Property: Patents, Trademarks and Copyright in a Nutshell, West Group Publishers (2000)
- Jayashree Watal, Intellectual property rights in the WTO and developing countries, Oxford University Press, Oxford


**PCMA-501: Content cum Pedagogy of Mathematics (CCPM-II)**

| | |
|---|---|
| Credits: 1L+1T+0P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

The teaching learning of Mathematics is a complex activity, and many factors determine the success of this activity. The nature and quality of instructional material, the presentation of content, the pedagogic skills of the teacher, the learning environment. Students at this stage are keen in exploring and constructing their own knowledge, so facilitating with resources is important for the schoolteacher. This course will provide illustrative exposure to the resource materials for Mathematics teaching learning. Teaching Mathematics requires a thorough understanding of the pedagogical content knowledge. It is the integration or the synthesis of teachers' pedagogical knowledge and their subject matter knowledge that comprises pedagogical content knowledge. Planning of the learning experiences is a must for the quality learning outcome and the better use of resources. This course provides skills to develop the planning of Mathematics teaching learning for classroom. This course also extends the support of technology integration for enhancement of pedagogical planning. The course will be helpful for Student teachers in knowing how the mathematical content knowledge is organized and used in the teaching learning process with support of technological tools.

**Course Learning Outcomes**

After completion of the course, student teachers will be able to:

- discuss the nature and functions of various instructional resources,
- explore and utilize the teaching learning resources to support pedagogical experiences of Mathematics,

- organize and manage supportive activities for development of mathematical aptitude of secondary school students,
- plan appropriate experiences for teaching Mathematics,
- explore diverse backgrounds and interests' children bring to set up the inclusive classroom for Mathematics learning,
- elaborate technological tools for teaching and learning of Mathematics,
- integrate technology to judiciously facilitate learning for enhancing inclusive environment.

**UNIT - I**

Teaching Learning Resources

a) Teaching learning materials: meaning and importance for secondary school Mathematics.
b) Types of teaching learning resources: print media (Mathematics textbook, teachers' manual/ handbook, laboratory manual), non-print and digital media (charts, 2-D and 3-D models, games, web resources, interactive boards, animations, videos, images, simulations) for offline/ online classroom teaching and learning
c) Identification and use of learning resources in Mathematics from the local environment, community resources and pooling of resources.
d) Mathematics resource room/ laboratory – equipment and management, concept of virtual laboratories.
e) Organization of Mathematics club, fairs, exhibitions, learner community.

**UNIT – II**

Content Analysis and Planning for Teaching Mathematics

a) Analysis for identification of axioms, concepts, rules, formulas, theorems, corollaries; pedagogical content knowledge of arithmetic, algebra, geometry, mensuration, and trigonometry of secondary stage.
b) Planning and evaluating learning experiences in an inclusive setup based on learning outcomes and competencies, building a community of mathematicians in classrooms.
c) Developing annual plan, unit plan, lesson plan – need, main consideration, and format.
d) Strategies for method-based lesson plan for secondary classes - inductive-deductive, analytical- synthetical, lecture cum demonstration, problem-solving, laboratory, and project based.

**UNIT – III**

ICT Integration and Applications in Teaching of Mathematics

a) Scope and importance of ICT for teaching and learning Mathematics.
b) Use of ICT (digital repository, Augmented Reality (AR), Virtual Reality (VR) and Artificial Intelligence (AI) based digital resources, open education resources, blogs, forums, interactive boards, and devices) in the teaching learning, assessment and resource management of secondary Mathematics.
c) Use of tools, software, and platforms such as GeoGebra, Khan Academy along with national teacher's portal, DIKSHA, SWAYAM.
d) Developing ICT integrated lesson plans using Technological Pedagogical Content Knowledge (TPCK) for Mathematics classroom and online teaching.

**Suggestive Practicum (Best out of Two)**

- Develop learning resources for Mathematics teaching learning.
- Prepare annual plan for any secondary class.
- Prepare a unit plan from the Mathematics textbook at secondary stage.
- Prepare learning outcomes-based lesson plan using experiential learning for any one topic of Mathematics at secondary stage.
- Develop a lesson plan on a topic of Mathematics at secondary stage by integrating ICT tools.
- Write script for developing e-content on any one topic of Mathematics for online teaching.
- Any other Project assigned by HEI.

**Suggestive Mode of Transaction**

Lecture cum discussion, group work, ICT enabled methods, Activity based and Art
Integrated Demonstration, Field-based experiences, Library Visits, Self-study, Field observations, Assignment preparation, Classroom presentations, Discussion forums, observation, Flip classroom, Use of digital platform

**Suggestive Mode of Assessment**
Written test, classroom presentation, workshop, assignments, practicum, sessional and terminal semester examination.

**Suggestive Reading Materials**
- NCERT: A Handbook for Designing Mathematics Laboratory in Schools (Code- 1555)
- NCERT: Manual for Higher Secondary Mathematics Kit (Code- 3165)

*Teachers may also suggest books/readings as per the need of the learners and learning content.

**PCPS-502: Content cum Pedagogy of Physical Sciences (CCPPS-II)**

| | |
|---|---|
| Credits: 1L+0T+1P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**
This course comprises three units and the practicum. The course is devoted to introducing various teaching aids material types and uses for teaching the concepts of physical sciences at secondary stage. Enough space is provided to discuss different types of teaching aids/materials for teaching learning concepts of physical sciences. It focuses on learning resources in physical sciences to enable student teachers to make use of available learning resources and how to generate new resources for teaching learning the concepts of physical sciences. It also focuses on textbook analysis and planning for teaching physical sciences. and its pedagogical issues in the light of NEP 2020. Student teachers are expected to identify various concepts and processes, list learning and outcomes, find out about various activities and experiments. Accordingly, they are expected to develop lesson plan based on learning outcomes and experiential learning for classroom and online teaching.

**Course Learning Outcomes**
After completion of this course, student teachers will be able to:

- identify teaching learning aids / materials and illustrate their importance in teaching learning the concepts of Physical Sciences,
- categorize teaching aids/materials/learning resources,
- develop teaching learning aids/material/kits/learning resources for teaching learning the concepts of Physical Sciences,
- utilize teaching aids/materials/learning resources for teaching learning the concepts of Physical Sciences,
- analyze the content of physical sciences textbooks at secondary stage,
- develop lesson plan based on learning outcomes and experiential learning using appropriate strategies.

**UNIT - I**

Teaching Learning Resources

a) Teaching learning aids/materials: concept, definition, role and importance in classroom teaching learning the physical sciences.
b) Types of teaching learning aids/ materials: print media such as textbook, teachers' manual/ handbook, laboratory manual and other print materials, non-print and digital media such as radio, TV, websites, animations, audios, videos, images, simulations, digital repository, Augmented Reality (AR), Virtual Reality (VR) and Artificial Intelligence (AI) based digital resources and Open Educational Resources (OERs) for offline/ online classroom teaching learning reflective journals, charts, 2-D and 3-D models, games, cards, worksheets, multimedia.
c) Identification and use of learning resources in physical sciences from the local environment.
d) Resource room/ laboratory/ library, virtual laboratories, teaching learning kits, physical sciences clubs, fairs, exhibitions, educational parks, excursions, community resources and pooling of resources.

**UNIT - II**

Content Analysis and Planning for Teaching Physical Sciences

a) Pedagogical analysis of content taking examples from topics of physical sciences textbooks at secondary stage, identification of concepts, listing learning outcomes and competencies, planning, and evaluating learning experiences in an inclusive setup.
b) Concept, types and importance of unit and lesson planning.
c) Developing unit plans and lesson plans based on learning outcomes and experiential learning by selecting topics from textbooks of physical sciences at secondary stage.

**UNIT - III**

ICT Integration and Applications

a) Scope and importance of ICT in physical sciences.
b) Use of ICT such as Artificial Intelligence, machine learning, smart boards in the teaching learning, assessment, and resource management.
c) Tools, software, and platforms for teaching learning of physical sciences at secondary stage.
d) Developing ICT integrated lesson plans by taking topics of physical sciences at secondary stage using Technological Pedagogical Content Knowledge (TPCK) for classroom and online teaching.

**Suggestive Practicum (Best out of Two)**

- Develop e-content for the concepts of Physical Sciences at Secondary Stage.
- Analyze the content of textbooks of Physical Sciences (Classes 9-12).
- Identify the learning resources for transiting the concepts of Physical Sciences.
- Develop teaching aids/teaching materials for teaching concepts of Physical Sciences at secondary stage.
- Develop learning outcomes for the concepts of Physical sciences at the secondary stage.
- Prepare learning outcomes and experiential learning-based lesson plan for the concepts of Physical Sciences.
- Develop a project on the concepts of Physical Sciences using interdisciplinary and multidisciplinary approaches as recommended in NEP 2020.
- Any other project assigned by HEI.

**Suggestive Mode of Transaction**
Lecture cum discussion/demonstration, hands-on activities, demonstration, discovery approach, project approach, inquiry approach, experimentation, problem-solving, concept mapping, experiential learning and ICT integrated approach.

**Suggestive Mode of Assessment**
Written test, classroom presentations, workshops, seminars, assignments, practicums, sessional and terminal semester examinations.

**Suggestive Reading Materials**
- Draft National Curriculum Framework for School Education,
- Laboratory Manual of Science (Grade 9 & 10), NCERT.
- National Education Policy 2020, MoE, Government of India.
- National Steering Committee for National Curriculum Frameworks, (2023).
- NCERT Laboratory Manuals.
- NCERT Textbooks, Chemistry for Class XI and XII.
- NCERT Textbooks, Physics for Class XI and XII.
- NCERT Textbooks, Science for Class IX and XI.

*Teachers may also suggest books/readings as per the need of the learner and learning content.

**PCBS-503: Content cum Pedagogy of Biological Sciences (CCPBS-II)**

| | |
|---|---|
| Credits: 1L+0T+1P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**
A wide array of teaching-learning resources is available to modern day teachers. This course comprises of three units which aims to introduce various resources and discuss their appropriate utilization in teaching. In this course, student teachers are introduced to different units and lesson plan based on learning outcomes and experiential

learning. Requisite skills such as the use of print media, non-print media and digital resources are discussed in the course. This course also focuses on familiarizing student teachers in ICT integration in teaching and preparing ICT based lesson plans for online teaching using suitable tools. This course aims to prepare student teachers for teaching Biological Sciences using different dimensions pedagogical and technological aspects.

**Course Learning Outcomes**

After completion of this course, Student teachers will be able to:

- categorize different teaching learning resources and plan their appropriate usage in teaching learning of concepts of Biological Science,
- develop simple teaching learning materials using easily available/local materials,
- analyze the content of Biological Science textbooks at secondary stage,
- review various methods and strategies for teaching Biological Sciences,
- develop learning outcome-based lesson plan to promote experiential learning and higher order thinking skills,
- develop unit plans and lesson plans on different chapters in biology (Grades IX to XII).

**UNIT - I**

Teaching Learning Resources

a) Teaching learning aids/materials: concept, definition, role, and importance in classroom teaching learning the Biological Sciences.
b) Types of teaching learning aids/ materials: print media such as textbook, teachers' manual/ handbook, laboratory manual and other print materials, non-print and digital media such as museum, aquarium, terrarium, games, toys, radio, TV, websites, animations, audios, videos, images, simulations; Biological Sciences mobile apps, digital repository, Augmented Reality (AR), Virtual Reality (VR) and Artificial Intelligence (AI) based digital resources and Open Educational Resources (OERs) for offline/ online classroom teaching learning (reflective journals, charts, 2-d and 3-d models, games, cards, worksheets, multimedia etc.
c) Identification and use of learning resources in Biological Sciences from the local environment - using nature as a laboratory; biology laboratory - designing, management and safe practices; virtual laboratories and museums.
d) Resource room/ laboratory/ library, virtual laboratories, teaching learning kits, Biological Sciences clubs, fairs, exhibitions, science parks, zoo, botanical gardens, excursions community resources and pooling of resources.

**UNIT - II**

Content Analysis and Planning for Teaching Biological Sciences

a) Pedagogical analysis of content taking examples from topics of Biological Sciences textbooks at secondary stage, identification of concepts, listing learning outcomes and competencies, planning, and evaluating learning experiences in an inclusive setup.
b) Concept, types and importance of unit and lesson planning.
c) Developing unit plans and lesson plans based on learning outcomes and experiential learning by selecting topics from textbooks of Biological Sciences at secondary stage.

**UNIT - III**

ICT Integration and Application

a) Scope and benefits of using IT in teaching learning process; Artificial Intelligence, machine learning, smart boards.
b) Specific features and limitations of using ICT.
c) Open Educational Resources in Biological Sciences – BIOIDAC, MOOC, National Teachers Portal, DIKSHA, SWAYAM.
d) Developing ICT integrated lesson plans by taking topics of physical sciences at secondary stage using Technological Pedagogical Content Knowledge (TPCK) for classroom and online teaching.

**Suggestive Practicum (Best out of Two)**

- Analyze the content of textbooks of Biological Sciences (Classes 9-12).
- Develop e-content for the concepts of Biological Sciences at Secondary Stage.

- Develop unit plans of selected chapters of Textbooks of Biological Sciences.
- Prepare learning outcomes and experiential learning-based lesson plan for the concepts of Biological Sciences.
- Developing ICT integrated lesson plans for offline and online classes.
- Explore a course of Biological Sciences of MOOC and prepare a write up.
- Any other project assigned by HEI.

**Suggestive Mode of Transaction**
Lecture cum discussion, demonstration, Hands-on activities, experiential learning, inquiry, Group work, Presentations, multimedia.

**Suggestive Mode of Assessment**
Written tests, classroom presentations, workshops, seminars, assignments, practicums, sessional and terminal semester examinations.

**Suggestive Reading Material**
- National Council of Educational Research and Training. (April 2022). Mandate documents Guidelines for the development of National Curriculum Frameworks.
- National Education Policy 2020, MoE, Government of India.
- National Steering Committee for National Curriculum Frameworks, (2023). Draft National Curriculum Framework for School Education.
- NCERT, Textbooks of Biological Sciences at Secondary Stage.

*Teachers may also suggest books/readings as per the need of the learner and learning content.

**AEVA-501: ICT in Education**

| | |
|---|---|
| Credits: 1L+0T+1P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

The present course focuses on moving beyond computer literacy and ICT-aided learning, to help student teachers interpret and adapt ICTs in line with educational aims and principles. The paper will orient the learners about the need for and importance of ICT in education. It will describe the importance of opensource software in education. Students will be given exposure to the various approaches and stages towards the use of ICT in education. Students are expected to develop reasonably good ICT skills in terms of the use of various computer software and ICT tools.

**Course Learning Outcomes**

On completion of this course, student teachers will be able to:

- explain the concept, nature, and scope of ICT in education,
- describe the importance of open-source software in education,
- list and explain various approaches to the adoption and use of ICT in education,
- describe the importance of various emerging technologies in education,
- See relationship between the social, economic, and ethical issues associated with the use of ICT,
- list out the challenges of educational technology in India,
- use various technological tools for improving teaching-learning- assessment processes.

**UNIT - I**

Introduction to (ICT) in Education

a) Meaning, Nature, importance of Information Technology, Communication Technology & Information and Communication Technology (ICT) and Instructional Technology,
b) Educational Technology and ICT in Education (Difference, Scope of ICT- Teaching, learning, Research & Publication Educational Administration and Assessment),
c) Technology & Engagement: Internet, Collaborative learning through Online Discussion Forums, group assignments & Peer reviews,
d) Meaning and Uses of Systems Approach in instructional design,
e) Models of Development of Instructional Design (ADDIE, ASSURE, Dick and Carey Model Mason's),
f) Flanders' Interaction Analysis Category System (FIACS),
g) Challenges relating to Educational Technology.

**UNIT - II**

Emerging Technologies in Education

a) E-learning Concept, methods, and media (LMS, Virtual Universities, Massive Open Online Course (MOOCs), Indian MOOCs, Types of MOOCs: cMOOCs, xMOOCs & LMOOCs).
b) Open Education Resources (Creative Commons, Concept, and application).
c) Augmented reality, Virtual reality, Artificial intelligence, Mixed Reality & Gamification in education (Meaning, history, importance, tools and uses).
d) Cloud Computing & Internet of Things - Meaning, importance and uses.
e) Ethical issues & safety in ICT- (Teaching, Learning and Research, Cyber bullying, Cyber security literacy & data protection, Online identity and privacy).

**UNIT – III**

ICT in Teaching-Learning & Assessment

a) Concept, Approaches to integrating ICT in teaching and learning: Technological Pedagogical Content Knowledge (TPCK), Technology Integration Matrix (TIM).
b) Implication of Learning Theories in ICT in Education: Behaviourism, Cognitivism & Constructivism.
c) Developing functional skills to use discipline specific ICT tools (Geogebra, PhET, Stellarium, Open Street Map, Marble, Turtle Art, Technological tools for Mind mapping etc.).
d) ICT and Assessment- Electronic assessment portfolio – Concept and types; e-portfolio tools.
e) Online and offline assessment tools – Rubrics, survey tools, puzzle makers, test generators, reflective journal, question bank.
f) ICT applications for Continuous and Comprehensive Evaluation (CCE).

**Suggestive Practicum**

- Prepare an assessment tool on any one chapter of the textbook.
- Explore any one online platform for MOOCs and prepare a report highlighting its structure and courses.

**Suggestive Mode of Transaction**

The pedagogy for the course ICT in Education should be designed to ensure that students have a good understanding of how to use technology for improving teaching-learning-assessment processes. It should provide a balance between theoretical knowledge and practical skills. The approaches to curriculum transaction may include the following:

- Active learning encourages student teachers to participate in discussions, brainstorming sessions, and problem-solving activities that help them develop critical thinking and problem-solving skills.
- Collaborative learning involves group projects and tasks that encourage student teachers to work collaboratively and learn from each other.
- Experiential learning involving Hands-on activities, field trips, and real-life scenarios that will give student teachers the opportunity to apply their knowledge and skills in a practical setting.
- Use of multimedia tools such as videos, interactive simulations, and animations that help enhance learning and make it more engaging.
- Self-directed and self-managed learning activities that encourage students to take charge of their learning process through independent research, self-reflection, and self-assessment which can promote lifelong learning.

**Suggestive Mode of Assessment**

The assessment for the course ICT in Education should evaluate students' knowledge, capacities, and attitudes towards the use of technology in education. The assessment methods will include the following:

- Project-based assessments involving projects that require student teachers to create an instructional/learning resource that incorporates ICT tools and then assess the quality of the resource.
- Peer assessment helps students develop their critical thinking and evaluative capacities through group tasks requiring assessment by a group of the work of another group.
- Reflective journals requiring student teachers to maintain a reflective journal and to reflect on their learning experience involving the use of ICT tools in education.
- Online quizzes and tests involving online quizzes and tests that can assess students' knowledge of the theoretical aspects of ICT in education.
- Observation and feedback involving observation of performance of student teachers during classroom activities and providing feedback that help assess their practical skills in using ICT tools for improving teaching-learning-assessment processes.

**Suggested Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning content.

## EDSE-501: Pre-Internship Practice (Demo, Lessons, Peer Teaching)

| | |
|---|---|
| Credits: 1L+1T+0P | Marks 50 |
| Contact hours per week: 3 | |
| Internal Evaluation (internship practice will be conducted by the Institute) | 50 |

| **Distribution Marks for the course** | | |
|---|---|---|
| Paper | Max.Marks | Min. Pass Marks |
| Internal Evaluation | 50 | 20 |
| **Total Marks** | 50 | |

**About the Course**

Pre-Internship is a vital component of the Teacher Education Programme. It is a prerequisite for the student teachers to experience a simulated classroom environment to prepare them for real- life situations. Student teachers get exposure in a conducive, guided environment to manage a classroom and learn pedagogic and classroom management skills and get an opportunity to have hands-on experience.

**Suggestive Structure**
ITEP 5th semester has a Pre-Internship Pracice (Demo, Lessons, Peer Teaching) for a period of 2 weeks where student teachers need to gain hands on experiences in a simulated classroom environement to prepare them for real life situations.

**Course Learning Objectives:**
After completion of the course, student teachers will be able to:

- acquainted with various pedagogic practices, classroom management skills, assessment tools and learning standards,
- get experience of conducting classes by observing lessons transacted by teacher educators (demonstration lessons),
- develop lesson plans to transact them using appropriate pedagogies and learning resources,
- develop and practice teaching skills in a guided environment to be an effective teacher,
- be prepared for the school internship.

**Suggestive Mode of Transaction**

- Demonstration lesson (minimum 1 in each pedagogical subject)
- Peer Group teaching and peer observation (minimum 5 in each pedagogical subject)
- Observation of lessons by teacher educators during peer group teaching
- Reflective group discussions/workshops/seminars
- Preparation and presentation of the video content illustrating best classroom practices.

**Content**
The pre-internship will include activities relating to the stage-specific pedagogy courses, ability enhancement and value-added courses and foundation courses transacted during previous semesters. It will also include knowledge of pedagogy, formats of lesson plans, different ICT tools, schooling systems in India, principles of classroom management, assessment, and other relevant content.

**Activities to be conducted:**

- Observation of lessons transacted by teacher educators to identify pedagogic skills.
- Exposure to various types of lesson plans through workshops.
- Development of relevant Teaching Learning Materials (TLMs).
- Participation in screening and discussion of educational videos on pedagogy and assessment.
- Learning about inclusiveness in school education
- Orientation for Action Research/case study

**Secondary Stage**

- Orientation of student teachers to different pedagogic approaches like storytelling, art- integrated, sports-integrated, project-based, and ICT-integrated for developing critical thinking, attention to life aspirations, and greater flexibility and classroom management skills.
- Observation of the lesson demonstrated by teacher educators/experts in the institute.
- Designing guided activities, including a laboratory for each class/subject based on learning outcomes.
- Study Secondary Stage Learning Standards in the NCF
- Content analysis and development of the unit plan, concept map and lesson plan.
- Discussion on unit plan and lesson plan with teacher educators/experts
- Preparation of a Portfolio (for self-work) that the student-teacher will use to keep all her/his work.
- Participate in discussions/reflective sessions for conceptualizing teaching-learning practices.
- Exploring available learning resources and educational videos
- Developing local, low-cost, and innovative TLM s
- Reading and reflecting on inspiring books on pedagogic practices

**Assessment**

| S.No. | Activities | Marks |
|---|---|---|
| 1 | Demonstration lesson (minimum 1 in each pedagogical subject) | 5+5=10 |
| 2 | Peer Group teaching and peer observation (minimum 5 in each pedagogical subject) | 10+10=20 |
| 3 | Observation of lessons by teacher educators during peer group teaching | 5 |
| 4 | Reflective group discussions/workshops/seminars | 5 |
| 5 | Preparation and presentation of the video content illustrating best classroom practices | 10 |
| Total | | 50 |

| Competence/Artifact | Method of assessment | Assessed By | Credits |
|---|---|---|---|
| Classroom teaching skills and assessment tools (including learning standards) | Simulated Presentation | Teacher Educator | 1 |
| Reflective group discussions/workshop | Observations | Teacher Educator | 0.5 |
| Artefacts (Lesson Plans, TLM, Curated Videos) and action research procedures. | Evaluation | Teacher Educator | 0.5 |

**Outcomes**

After completion of the course, student teachers will be able to:

1. Describe the prerequisites of the internship
2. Demonstrate knowledge of pedagogic practices, classroom management skills, assessment tools and learning standards
3. Develop lessons plans and relevant Teaching Learning Materials (TLMs)
4. Develop readiness to take up an internship programme.

# SEMESTER VI

**EDFE-601: Assessment & Evaluation**

| | |
|---|---|
| Credits: 1L+0T+1P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

The main thrust of this course on assessment and evaluation is to equip student teachers with the knowledge and capacities required to develop and implement approaches to assessment that is more regular and formative, is more competency-based, is appropriate for assessing learning outcomes relating to all domains of learning, is appropriate for testing not only subject-related learning but also generic learning outcomes such as problem solving, critical thinking, creative thinking, communication skills, judgement and decision making, ethical and moral reasoning etc.

**Course Learning Outcomes**

After completion of this course, student teachers will be able to:

- use different approaches to assess and evaluate of student performance such as time-constrained examinations; closed/open-book tests; problem-based assignments; practical assignment reports; observation of practical skills; individual and group project reports; oral presentations; viva voce interviews; computerized adaptive testing; peer and self- assessment etc.,
- develop and use informal and formal diagnostic, formative, and summative assessment strategies to monitor student learning levels and help the teacher continuously revise teaching-learning processes to optimize learning and development for all students,
- develop an understanding among student teachers of the approaches to provide timely, effective, and appropriate feedback to students about their performance relative to the expected learning outcomes and organizing learning enhancement initiatives that are required to bridge the gap in student learning levels,
- present report on student achievement, making use of accurate and reliable records etc.
- develop assessment “as”, “of”, and “for” learning that are aligned to the expected learning outcomes,
- design the progress card of students based on school-based assessment to make it a holistic, 360-degree, multidimensional report that reflects the progress as well as the performance of learners assessed through

self-assessment and peer assessment, project- based and inquiry-based learning, quizzes, role plays, group work, portfolios, etc., along with teacher assessment that would provide students with valuable information on their strengths, areas of interest, and needed areas of improvement.

**UNIT - I**

Assessment and Education

A. Assessment and Evaluation
- Meaning and significance of assessment and evaluation in educational field.
- Conceptual Clarity and purpose of Measurement, Assessment, Examination, Appraisal and Evaluation in Education.
- Learning outcomes across the stages and assessment.
- Taxonomy of Objectives (Revised in 2001) and Implications.

B. Forms of Assessment
- Formative, Summative, diagnostic, prognostic.
- Internal and External assessment.
- Assessment For learning, of learning and as learning.
- Authentic Assessment; Online Assessment.

C. Improving Assessment and Evaluation in Schools: Brief Historical Review (1975, 1988, 2000, 2005, 2020)

**UNIT - II**

Process of Assessment and Evaluation

A. Formative and Summative Assessment: Concept and Characteristics.

B. Approaches to assess and evaluate student performance such as time-constrained examinations; closed/open-book tests; problem-based assignments; practical assignment reports; observation of practical skills; individual and group project reports; oral presentations; viva-voce interviews; computerized adaptive testing; peer and self- assessment etc.

C. Assessing Higher Order Thinking Abilities: Problem solving, critical thinking, creative thinking, communication skills, judgement and decision making, ethical and moral reasoning.

D. Tools and Techniques
- Observation, rating scale, check list, anecdotes, interviews.
- Assessment of attitudes and interests.
- Socio-metric techniques.
- Criteria for assessment of social and personal behaviour.
- Self-assessment and Peer Assessment.

**UNIT - III**

Analysis and Interpretation

A. Analysis of students' performance and scores: credit and grading

B. Graphical representation (Histogram, Frequency Curves)

C. Interpretation of student's performance based on the analysis and their further uses in improving learner's performance: credit and grading, constructive feedback.

D. Reporting student's performance: 360-degree progress reports, cumulative records and their uses, portfolios, PTA meetings, qualitative reporting based on the observations, descriptive indicators in report-cards.

**Suggestive Practicum**
- Review of various education commissions, Policies & reports and NCF to get a brief view of the recommendations on Assessment and Evaluation.
- Constructing a unit test using table of specifications.
- Construction of any one of the tools (rating scale, check list, observation schedule, etc.) and administering it to group of students or using it to observe the school and classroom environment and interpreting it.
- Analysis of question papers of various Boards.
- Analysis of report cards - State and Central (CBSE)
- Preparing format of 360-degree report Card.

- Review of learning outcomes by NCERT in different subject areas.
- Interviews with teachers and students to study the assessment practices, issues and problems related to it followed by presentation.
- Reviewing Assessment Discussions in NEP (2020).

**Suggestive Mode of Transaction**
The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

**Suggestive Mode of Assessment**
The assessment will be based on the tests and assignments.

**Suggestive Reading Materials**
Teachers may suggest books/readings as per the need of the learners and learning content

**EDFE-602: Inclusive Education**

| | |
|---|---|
| Credits: 1L+0T+1P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc. (at the end of 15th Week).

**About the Course**
This course seeks to orient student teachers to the approaches to bridging gender and social category gaps in terms of participation rates and student learning levels at all levels of school education. The course will provide orientation

to the strategies pursued and required to improve participation and learning levels of children from Socio-Economically Disadvantaged Groups (SEDGs) that can be broadly categorized based on gender identities, particularly female and transgender individuals, socio-cultural identities (such as Scheduled Castes, Scheduled Tribes, OBCs, and minorities), geographical identities (such as students from remote locations, villages, small towns, and aspirational districts), disabilities (including learning disabilities), linguistic identities, and socio-economic conditions (such as migrant communities, low income households, children in vulnerable situations, including orphans and the urban poor).

**Course Learning Outcomes**

After completion of this course, student teachers will be able to:

- ensure inclusion and equal participation in education of children with disabilities in the regular schooling process that allows students with and without disabilities learn together, ensuring their retention in the school system, and enabling them to achieve the defined learning outcomes,
- adapt teaching and learning process to meet the learning needs of different students with disabilities, including providing education and opportunities for participating in arts, sports, and vocation-related activities, making school buildings and compounds as well as other facilities barrier free and accessible for children with disabilities, supporting activities that help the provision of individualized learning environment and learning activities/resources, making available assistive devices and appropriate technology-based tools, as well as adequate and language-appropriate teaching-learning materials (e.g., textbooks in accessible formats such as large print and Braille) to help children with disabilities integrate more easily into classrooms and engage with teachers and their peers, using appropriate modes and means of communication, detecting specific learning disabilities in children at the earliest and taking appropriate measures to overcome them, monitoring completion of education and learning levels of students with disabilities etc.

**UNIT - I**

Inclusion and Education

A. Conceptual Clarity, relation, and significance with special reference to:
- UNCRPD, 2006,
- RPWD Act, 2016,

With special reference to Indian Context.

B. Clarity of various terms and phrases associated with Inclusive Education: Integrated Education, Special Education, Impairment and Disability, Assessment and Evaluation, Curriculum, adaptation, modification and differentiation, universal design of learning
C. Shifting from Disability to the Inclusive view.
D. Shifting Paradigms from Bio centric to Human Rights.
E. Introductory reference of Policies/Acts with reference to educational implications for Children with Disabilities: Right to Education Act, 2009/ 2012, RPWD Act, 2016, UNCRPD, National Trust Act, 1999, National Educational Policy, 2020.

**UNIT - II**

Children with Disabilities and Marginalized Groups

A. Nature and needs of children with sensory impairments: cognitive impairments and intellectual disability, physical disabilities, cerebral palsy, multiple disabilities.
B. Specific needs of children with behavioral, emotional learning disabilities
C. Health Problems.
D. Educational needs of children belonging to Marginalized Groups.

**UNIT - III**

Pedagogical Issues

A. Conceptual clarity and significance.
B. Meeting the specific needs of Children with Disabilities with special reference to:
- education and opportunities for participating in arts, sports, and vocation-related activities,
- making school buildings and compounds as well as other facilities barrier free and accessible
- supporting the learning activities and resources for individualized learning environment
- making available assistive devices and appropriate technology-based tools,

- language-appropriate teaching-learning materials (e.g., textbooks in accessible formats such as large print and Braille)
- assessing strategies

C. Designing strategies assessment for inclusive classrooms.

**Suggestive Practicum**

- Developing a checklist for identifying the various needs of children with disabilities.
- Visiting schools of different categories and talking to parents, teachers, and Children with and without disabilities and listing the problems faced by these children and the families at the local level in gaining access to education.
- Analyzing RPWD Act 2016 and list its implications for CWD in inclusive settings.
- Outlining the problems faced by children with Visual Disabilities while learning mathematics and EVS.
- Giving a few exemplary adaptations based on the Preparatory Level textbooks.
- Outlining the problems faced by children with hearing impairments while learning language. Give a few exemplar adaptations based on the primary level textbooks.
- Students work in small groups of 10 or so to prepare a street play highlighting the meaning and provisions of inclusive education.
- Analyzing the Context of NEP 2020 in the light of Inclusive Education.

**Suggestive Mode of Transaction**

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

**Suggestive Mode of Assessment**

The assessment will be based on the tests and assignments.

**Suggestive Reading Materials**

Teachers may suggest books/readings as per the need of the learner's and learning content.

**DCBO-601: Plant Biotechnology**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| Distribution Marks for the course | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –

1. know the fundamental principles of plant tissue culture
2. Differenciate the different techniques of sterilization.
3. Know the basic tools and techniques of genetic engineering.
4. Apply the genetic engineering in day to day life..

**UNIT-I**

Historical background, terminology used in cell and tissue culture, Tools and Techniques in Plant Tissue Culture, Media Preparations, Solid media, Liquid media, sterilization techniques, sterilization of glasswares and medium, Aseptic manipulation and Culture maintenance, Inoculation and Sub culture.

**UNIT-II**

Concept of Cellular totipotency, Methods of application of micro propagation, Haploid production, Zygotic embryo culture, Endosperm Culture, Protoplast culture, Somatic embryogenesis and Synthetic Seeds.

**UNIT-III**

An Overview of Genetic Engineering, Tools & Techniques of genetic engineering, recombinant DNA technology ,

**UNIT-IV**

Methods and applications in agriculture, horticulture, pharmaceuticals, Genetic markers, PCR. Concept of genomics and proteomics, application of biotechnology.

**Suggested Readings:**


- Molecular Biology of the Cell, Alberts al, 5th ed, Garland Science 2008
- Molecular Biology of the Gene Watson Baker et al, 7th ed, Pearson 2014.
- Vasil. I.K. and Thorpe, T.A. 1994, Plant Cell and Tissue Culture, Kluwer Academic Publishers, The Netherlands.
- R.W. Old and S.B. Primorse: Principle of gene manipulation: An introduction to genetic engineering.
- Genetics and Biotechnology, Dr KC Soni Hindi Edition, College book centre Chaura Rasta Jaipur.
- Microbiology and biotechnology, Dr KC Soni Hindi Edition, College book centre Chaura Rasta Jaipur.
- R.W. Old and S.B. Primorse: Principle of gene manipulation: An introduction to genetic engineering.
- R.A. Meyers (Ed) : Molecular Biology and Biotechnology .( VCH Publishers )
- Genetics – Analysis and Principles- Robert J. Brooker , McGraw Hill
- Molecular Cell Biology 7th Ed, 2013- Lodish, Berk, Matsludaira, Kaiser Kriegar , Scott, Zipursky, Darnell,W.H Freeman And Co.
- Biotechnology – BD Singh ( Hindi Ed) , Kalyani Publisher B1/292, Ludhiana, -141008 Punjab
- Vasil. I.K. and Thorpe, T.A. 1994, Plant Cell and Tissue Culture, Kluwer Academic Publishers, The Netherlands.

**PRACTICALS**

**Course Content:**

1. Basic requirements of a tissue culture laboratory.
(a) Common Glassware, (b) test tubes, culture tubes and screw-capped tubes, (c). Petridish (d). Pipette (e). Pasteur pipette (f) Erlenmeyer flask (g).Volumetric flask (h) Cleaning glassware (i).Inoculation needle and inoculation loop (j). Bunsen burner (Spirit-lamp), (k) water baths (l). Autoclaves. (m) laminar air flow (n) Incubator (o) Hot air oven (p) Colony counter (q) pH meter (r) Electric balance (s) Spectro photometer (t) Centrifuse (u) binocular Microscope.
2. Method of using balance
Preparation of temporary cotton plug
Preparation of permanent cotton plugs.
Preparation of culture media
a) Preparation of liquid medium (broth)
b) Preparation of Solid media (PDA medium and plates)
c) Preparation of agar slants.
d) Preparation of agar deep tubes.
3. Methods of Sterilization.
4. Demonstration of the techniques of micro-propagation by using different explants, e.g. axillary buds, shoot meristems etc.

## DCCH-601: Advance Chemistry

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –

- Reflect upon basic principles of Nano chemistry/Green chemistry.
- Reflect upon stereochemistry of Transition Metal complexes.
- Describe the Asymmetric synthesis and the effects of stereochemistry on chemical reactivity.

- Apply stereochemical concepts to predict the behavior of chiral molecules and their interactions with other compounds.
- Perform and demonsrate the skills of synthetic organic chemistry through Functional Group Interconversion and devlop various skills of separation of organic compounds

**UNIT-I**

**New dimensions of Chemistry:**

Green Chemistry: History, need, and goals, Green chemistry and Sustainability, 12 Basic principles of Green Chemistry and their illustrations with examples, Examples of green synthesis/reaction: Green starting materials, Green reagents, Green solvents and reaction conditions, Green catalysis, Green synthesis- Real world cases (Traditional processes and green ones), Synthesis of Ibuprofen, Adipic acid etc and selected examples from US Presidential Green Chemistry Challenge Award Winners.

Nano Chemistry: Introduction to Nanochemistry, Nano and nature, nano the beginning, introduction to carbon Nanotubes; types, synthesis and purification, Brief introduction to self-assembled monolayers (SAMs), Monolayers on Gold, Preparation, Mixed monolayers, SAMs and applications; Sensors, affinity biosensors, chemical sensors, corrosion prevention, wetting control, molecular electronics, Process of synthesis of Nano powders, Sol-Gel process, Electro-Deposition, Plasma enhanced vapour decomposition, sputtering of Nano crystalline powders, Application of SEM, TEM and AFM to nanotechnology.

**UNIT-II**

**Isomerism of Coordination Compounds:** Isomerism's and stereochemistry, Classification of isomers, Study of constitutional and configurational isomerism, Optical activity of coordination compounds, symmetry requirements for optical activity, study of ORD, circular dichroism, cotton effect with special reference to complexes of Cr, Co, Ni and Pt.

Metal Clusters: Higher boranes, carboranes, and metalloboranes, metal carbonyl and halide clusters, compounds with metal-metal multiple bonds.

**UNIT-III**

**Asymmetric Synthesis**

Introduction to asymmetric synthesis, Cram's and Prelog's rules, Use of chiral auxiliaries, chiral catalyst (L-Proline based reaction), asymmetric hydrogenation, asymmetric epoxidation (Sharpless epoxidation) and asymmetric dihydroxylation, Enzyme catalyzed asymmetric reactions (Reduction and oxidations).

**UNIT-IV**

Oxidation- lntroduction, Different oxidative processes, Hydrocarbons-alkenes, aromatic rings, saturated C-H groups (activated and unactivated) Alcohols, diols, aldehyde's, ketones, ketals and carboxylic acids, Amines, hydrazines, and sulphides, Oxidations with ruthenium tetraoxide, iodobenzene diacetate and thallium( lll) Nitrate s oxidizing agent, Provost reaction, Wacker's process Barbier-Wieland degradation,

Reduction- lntroduction, Different reductive processes, Alkanes, alkenes, alkynes, and aromatic rings, Carbonyl compounds-aldehydes, ketones, acids and their derivatives, Epoxides, Nitro, nitroso, azo and oxime groups, Expoxide, Nitro, Nitroso, azo and oxime groups, Hydrogenolysis, reductions using Wilkinson's catalyst, Meerwein –Pondrof – Verley reduction

Functional Group Interconversion: Conversion of alcohols to alkylating agents, Installation and removal of protective groups and Interconversion of carboxylic acid derivatives.

**Suggested Readings:**


- Pradeep. T. Nano: The Essentials; Understanding Nanoscience and Nanotechnology. Tata McGraw-Hill Education Pvt. Ltd., New Delhi.
- Kenneth J. Klabunde and Gleb B. Sergeev Nanochemistry (Second Edition)
- Bandyopadhyay, A. K. Nano Materials. New Age International Publishers, New Delhi
- P.T. Anastas and J.C. Warner, Green Chemistry: Theory and Practice. Oxford University Press.
- Lancaster M. Green Chemistry: Introductory Text. Royal Society of Chemistry (London).
- Ryan M.A. and Tinnesand M. Introduction to Green Chemistry. American Chemical Society (Washington).
- Cann M. C. and Connelly M. E. Real world cases in Green Chemistry, American Chemical Society (Washington).

- Cann M. C. and Umile T. P. Real world cases in Green Chemistry (Vol 2) American Chemical Society (Washington)
- Ahluwalia, V.K., Kidwai, M. New Trends in Green Chemistry, 2004
- Advanced Inorganic Chemistry, F. A. Cotton and Wilkinson, John Wiley
- Inorganic Chemistry, J. E. Huhey, Harpes & Row
- Chemistry of the Elements, N.N. Greenwood and A. Earnshow, Pergamon
- Inorganic Polymers by Stone and Graham.
- Stereochemistry of Organic Compounds, D. Nasipuri, New Age International
- Stereochemistry of Organic Compounds, P.S Kalsi, New age International.
- Stereochemistry of Organic Compounds, E.L. Eliel.
- Organic Synthesis-Concept, Methods and Starting Materials, J. Fuhmop and G. Penzillin
- Guide Book to Organic Synthesis, R.K. Mackie & D.M. Smith, ELBS.
- Organic Synthesis, V.K. Ahuwalia and Renu Agarwal, Narosa
- Synthesis, Approaches in Organic Chemistry, R.K. Bansal, NarosaAdvanced Organic Chemistry - Reactions, Mechanism and Structure, Jerry March, John Wiley.


**Practical-VI**

**Credit of the Course: 1**

1. **Green Synthesis**

a) Preparation of acetanilide
b) Diels-Alder reaction between furan and maleic acid
c) Benzil-benzilic acid rearrangement
d) Nitration of phenol
e) Synthesis of dibenzalpropanone
f) Synthesis of adipic acid
g) Bromination of acetanilide

2. **Thin Layer Chromatography :**

Determination of Rf values and identification of organic compounds.

a) Separation of green leaf pigments (spinach leaves may be used)
b) Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5)

Paper Chromatography: Determination of Rf values and identification of organic compounds in a mixture of amino acids / monosaccharides.

3. **Physical Chemistry:**

a) First order reaction kinetics: Acid hydrolysis of an ester
b) Second order reaction kinetics: base hydrolysis of an ester (saponification)
c) Determination of cell constant of a given cell.
d) Determination of specific and equivalent conductance of the givenelectrolyte (NaCl) at different dilutions
e) Conductometric titrations of Strong Acid-Strong Base, Strong Acid-Weak Base, Weak Acid-Strong Base, Weak Acid-Weak Base.

4. **Spectroscopy**

To elucidate the structure of organic compounds with the help of UV, IR and NMR spectra.

5. Viva-Voce
6. Evaluation of record book of experiments performed in semester

**DCMA-601: Complex Analysis-II**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.

- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Complex Analysis- II**

**Course Learning Outcomes:** After completion of this course the student will be able to:

- Understand Cauchy residue theorem, Residue at infinity, Evaluation of integrals.
- Expand some simple functions as their Taylor and Laurent series, classify the nature of singularities, find residues and apply Cauchy Residue theorem to evaluate integrals.
- Understand the Conformal mappings, Mappings by elementary functions, Bilinear transformations.

**UNIT- I**

Functions of a complex variable, Differentiability and Analyticity, Harmonic Functions, Contour integrals, Antiderivative, Cauchy theorem, Cauchy-Goursat theorem, Simply and multiply connected domains, Cauchy integral formula, Higher order derivatives, Morera's theorem.

**UNIT-II**

Cauchy's inequality, Liouville's theorem, Fundamental theorem of algebra, Maximum modulus principle, Minimum modulus principle, Taylor's series, Laurent series, Absolute and uniform convergence of power series, Removable singularities, poles, Laurent expansions, essential singularities.

**UNIT-III**

Cauchy residue theorem, Residue at infinity, Evaluation of integrals, Definite integrals involving sines and cosines, Zeros of analytic functions, Uniqueness theorem, Zeros of polynomials, Argument principle, Rouche's theorem, Schwarz lemma, Schwarz-Pick lemma, Open mapping theorem.

**UNIT-IV**

Conformal mappings, Mappings by elementary functions, Bilinear transformation, Basic properties of Bilinear transformation, Fixed points, Cross-ratio, Mappings of half planes onto disks, Mappings by w=log z, Mappings by w=sin z, Mappings by z^2 and branches of z ^1/2.

**Recommended Readings:**


- Brown J.W. and Churchill R.V., 2009, Complex Variables and Applications, Tata McGraw Hill.
- Ponnusamy S., 2005, Foundations of Complex Analysis, Narosa Publication House.
- Kasana H.S., 2005, Complex Variables: Theory and Applications, PHI.

**DCPY-601: Nuclear and Particle Physics**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes:**
Student teachers will be able to:

- Discuss structure of nuclei, nuclear fission and fusion.
- Explain working principles of nuclear accelerators and detectors.
- Explain classification of elementary particles and conservation laws.

**UNIT-I**

Structure of Nuclei: Rutherford scattering, Structure of nuclei, basic properties (angular momentum, magnetic moment, Quadrupole moment and binding energy), deuteron binding energy, p-p and n-p scattering and general concepts of nuclear forces. Beta decay, range of alpha particles, Geiger-Nuttall law, Gamow‘s explanation of alpha decay, gamma decay, continuous and discrete spectra.

**UNIT-II**

Nuclear Fission: Theory of Nuclear Fission, Liquid Drop Model, Shell Model, Barrier Penetration-Theory of Spontaneous Fission, Nuclear Fission as a source of Energy, The Nuclear Chain reaction, Condition of controlled Chain Reaction, The Principle of Nuclear Reactors, Classification of Reactors, Power of Nuclear Reactors, Critical size of Thermal Reactors, The Breeder Reactors, Reprocessing of spent fuel, Radiation hazards and Fission products poisoning.
Nuclear Fusion: The sources of stellar energy, The Plasma: The fourth state of the matter, Fusion reaction, Energy balance and Lawson Criterion, Magnetic confinement of Plasma, Classical Plasma losses from the Magnetic Container, Anomalous losses, Turbulence and Plasma instabilities, The Laser Fusion Problem, Fusion reactor

**UNIT-III**

Accelerators: Ion sources, Cockcroft-Walton high voltage generators, Van de Graaff generators, Drift tube, Linear accelerators, Wave guide accelerators, 116 Magnetic focusing in Cyclotron, Synchrocyclotron, Betatron, The electromagnetic induction Accelerator, Electron synchrotron, Proton Synchrotron.
Detectors: Interaction of charged particles and neutrons with matter, working of nuclear detectors, Geiger-Muller counter, proportional counter and scintillation counter, cloud chambers, spark chamber, emulsions.

**UNIT-IV**

Elementary Particles: Classification of Elementary Particles, Fundamental interactions, Unified Approach (basic ideas), The Conservation laws, Quarks (basic ideas), Charmed and Colour Quarks, Higgs Boson, Large Hadron Collider.

**Suggested Readings:**


- Atomic and Nuclear Physics, T A Littlefield and N Thorley (Engineering Language Book Society)
- Introduction to Nuclear Physics, H A Enge(Addision-Wesly)
- Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, Eisenberg and Resnik, (John Wiley)
- Concepts of Modern Physics by Arthur Beiser (McGraw-Hill Book Company, 1987)
- Concepts of Nuclear Physics by Bernard L.Cohen.(New Delhi: Tata Mcgraw Hill,1998).
- Introduction to the Physics of Nuclei and Particles by R.A. Dunlap.(Singapore: Thomson Asia, 2004).
- Nuclear physics by Irving Kaplan
- Nuclear Physics by DC Tayal
- The Atomic Nucleus by RD Evans
- Atomic & Nuclear Physics, S.N. Ghoshal:– Vol. II, S. Chand, New Delhi.
- Nuclear Physics,SatyaprakshPragatiPrkashan Meerut
- Nuclear Physics, R. R. Roy and B. P. Nigam, , New Age Int.(P) Ltd


**DCZO-601: Biotechnology**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 28 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 40 | 3hr | |
| External Examinations: Practical | 30 | 3 hr | 12 |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)

C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:**

- Explain the concepts of DNA replication, DNA damage and repair, and gene expression in eukaryotic and prokaryotic organisms.
- Explain the basic principles and, the tools and techniques of Genetic engineering
- Describe the applications of genetic engineering in various fields.
- Debate on ethical issues concerned with Genetic engineering
- Illustrate the methodology to establish animal cell culture.
- Describe the importance of engineering animal cells for the production of therapeutic proteins.

**UNIT-I**

a) Concept and scope of biotechnology
b) Molecular Techniques in Gene manipulation: Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophage, M13, BAC, YAC, MAC and Expression vectors (characteristics).

**UNIT-II**

a) Restriction enzymes: Nomenclature, detailed study of Type II.
b) Transformation techniques: Calcium chloride method and electroporation.
c) Construction of genomic and cDNA libraries and screening by colony and plaque hybridization
d) Southern, Northern and Western blotting
e) DNA sequencing: Sanger method
f) Polymerase Chain Reaction, DNA Finger Printing and DNA micro array

**UNIT-III**

a) Genetically Modified Organisms: Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection
b) Applications of transgenic animals: Production of pharmaceuticals, production of donor organs, knockout mice.
c) Production of transgenic plants: Agrobacterium mediated transformation. Applications of transgenic plants: insect and herbicide resistant plants.

**UNIT-IV**

a) Culture Techniques and Applications: Animal cell culture, Expressing cloned genes in mammalian cells, Molecular diagnosis of genetic diseases (Cystic fibrosis, Sickle cell anemia)
b) Recombinant DNA in medicines: Recombinant insulin and human growth hormone, Gene therapy

**Practical:**

- Study of DNA in the *Drosophila*'s salivary gland chromosomes.
- Isolation of genomic DNA
- Molecular separations by chromatography, electrophoresis, precipitation etc.
- Isolation of milk protein from the milk sample.
- Separation of serum from blood by using centrifuge
- Separation of plasma from blood by centrifugation.
- Separation of biomolecules by paper and gel chromatography.
- Preparation and use of culture media for microbes.
- Preparation and use of culture media for animal tissues.
- Media preparation media sterilization and inoculation.
- Cell culture techniques- Design and functioning of tissue culture laboratory, cell proliferation measurements, culture media preparation and cell harvesting methods.
- Isolation and staining of bacteria. Students are expected to visit different laboratories (RRL, CSIR, ICMR, Science centers etc).

**Suggested Readings:**


- Molecular Biology of the Cell, Alberts al, 5th ed, Garland Science 2008
- Molecular Biology of the Gene Watson Baker et al, 7th ed, Pearson 2014.
- Biochemistry , Molecular Biology and Genetics 5th ed, Lippincott Williams and Wilkinson, 2013
- Biochemistry D Voet & JG Voet, Wiley 2011.
- Immunology , Kuby 7th ed, Owen Punt Stenford McMillan, 2013
- Fundamentals of Biochemistry , JL Jain , S Chand Pub 2014
- Essentials of Molecular Biology 2ed, David Freifileder, Panima Publishing N Delhi 1996.
- Genetics and Biotechnology, Dr KC Soni Hindi Edition, College book centre Chaura Rasta Jaipur.
- Microbiology and biotechnology, Dr KC Soni Hindi Edition, College book centre Chaura Rasta Jaipur.
- Biochemistry and Molecular Biology, K Wilson & J Walker, 7th Cambridge 2010.
- Animal Cell Culture – A practical approach, Ed, John, R.W. Masters IRL Press
- Gunther S. Stent, Molecular Genetics, MacMillian Publishing Co Inc.
- R.W. Old and S.B. Primorse: Principle of gene manipulation: An introduction to genetic engineering.
- R.A. Meyers (Ed) : Molecular Biology and Biotechnology .( VCH Publishers )
- Genetics – Analysis and Principles- Robert J. Brooker , McGraw Hill
- Principles of Cell and Molecular Biology –L.J Kleinsmith & V.M Kish, Harper Collins College Publisher.
- Molecular Cell Biology 7th Ed, 2013- Lodish, Berk, Matsludaira, Kaiser Kriegar, Scott, Zipursky, Darnell,W.H Freeman And Co.
- Bioinformatics, Sharma Munjal and Shankar, 2012 Rastogi Publications , Gangotri , Shivaji Road, Meerut-25002
- Biotechnology – BD Singh ( Hindi Ed) , Kalyani Publisher B1/292, Ludhiana, -141008 Punjab


## DECB-601: Tools and Technique in Botany

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –

- know the basic principles of instruments functioning.
- Explain the components of the instruments and techniques.
- Explain the functioning of the instruments.
- Perform and Handle/operate, the experiments with the help of these instruments.

**UNIT-I**

Basic Instruments and techniques: Working principles, basic operation and application of Microtome, weighing balance, PH meter, autoclave, Oven, laminar air flow, Water Baths, $CO_2$ Incubators, Shaking Incubators, Hot Air Ovens, Pipettes and MiliQ water system. Principle of aseptic and sterilization technique.

**UNIT-II**

Microscopy and its modifications – Working principles, basic operation and application Of Light, phase contrast and interference, Fluorescence, Confocal, Electron (TEM and SEM)
Centrifugation: Working principles, basic operation and application of micro-centrifuge, ultracentrifuge and density gradient centrifugation, applications (isolation of cell components).

**UNIT-III**

Chromatography techniques: Working principles, basic operation and application of TLC, gel permeation, ion exchange and affinity chromatography, HPLC. Spectroscopy technique: Working principles, basic operation and application of UV- visible spectroscopy, fluorescence, NMR, ESR, GC-MS, LC- MS, and X- ray crystallography.

**UNIT-IV**

Electrophoretic and PCR techniques: Working principles, basic operation and application of agarose, polyacrylamide and SDS-polyacrylamidegel electrophoresis, capillary electrophoresis, 2-D electrophoresis. Working principles, basic operation and application of Gradient PCR, RT PCR.

**Suggested readings:**

- Molecular Biology of the Gene Watson Baker et al, 7th ed, Pearson 2014.
- Genetics and Biotechnology, Dr KC Soni Hindi Edition, College book centre Chaura Rasta Jaipur.
- Microbiology and biotechnology, Dr KC Soni Hindi Edition, College book centre Chaura Rasta Jaipur.
- Biochemistry and Molecular Biology, K Wilson & J Walker, 7th Cambridge 2010.
- R.W. Old and S.B. Primorse: Principle of gene manipulation: An introduction to genetic engineering.
- Biotechnology – BD Singh (Hindi Ed) , Kalyani Publisher B1/292, Ludhiana, -141008 Punjab

**Tutorials:**
Basic requirements of a typical botany laboratory

**(1)** Common Glassware, (b) test tubes, culture tubes and screw-capped tubes, (c) Petridish (d) Pipette (e) Pasteur pipette (f) Erlenmeyer flask (g)Volumetric flask (h) Cleaning glassware (i) Inoculation needle and inoculation loop (j) Bunsen burner (Spirit-lamp), (k) water baths (l) Autoclaves (m) laminar air flow (n) Incubator (o) Hot air oven (p) Colony counter (q) pH meter (r) Electric balance (s) Spectro photometer (t) Centrifuse (u) binocular Microscope.
**(2)** Preparation of culture media
a) Preparation of liquid medium (broth)
b) Preparation of Solid media (PDA medium and plates)
c) Preparation of agar slants.
**(3)** Qualitative tests for carbohydrates.
**(4)** Qualitative test for proteins.
**(5)** Qualitative test for lipids.

**DECC-601 A: Polymer Chemistry**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes:** By the end of this course, students will be able to-

- Understand the fundamental principles of polymer chemistry, including polymerization mechanisms and kinetics.
- Identify the key properties of polymers, such as molecular weight, chemical structure, and thermodynamic behavior, and their impact on material performance.
- Apply knowledge of polymer synthesis techniques, including step-growth and chain-growth polymerizations, to design and create polymers with specific properties.
- Analyze the structure-property relationships in polymers and relate them to real-world applications, such as plastics, elastomers, and fibers.
- Evaluate the environmental and sustainability aspects of polymer chemistry, including the development of eco-friendly polymers and recycling processes.
- Demonstrate proficiency in characterizing and testing polymers using various analytical techniques, such as spectroscopy, microscopy, and rheology, to assess their quality and performance.

**UNIT-I**

Polymeric materials: Introduction, history, classification, nomenclature, molecular forces and chemical bonding, texture of polymers

Functionality and its importance: Formation of **s**ynthetic polymer, classification of polymerization processes, relationships between functionalities, extent of reaction and degree of polymerization, bifunctional systems, poly-functional systems.

Type of polymerization: Condensation, addition polymerization, and their mechanism

Kinetics of polymerization: Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques.

**UNIT-II**

Crystallization and crystallinity: Determination of crystalline melting point and degree of crystallinity, morphology of crystalline polymers, factors affecting crystalline melting point,

Nature and structure of polymers- Structure Property relationships

Determination of molecular weight of polymers (Mn, Mw, *etc.*) by end group analysis, viscometry, light scattering and osmotic pressure methods,molecular weight distribution and its significance, polydispersity index.

**UNIT-III**

Glass transition temperature (Tg): Introduction and its determination, free volume theory, WLF (Williams-Landel-Ferry) equation, factors affecting glass transition temperature (Tg)

Polymer Solution: Criteria for polymer solubility, solubility parameter and thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions, Flory- Huggins theory, lower and upper critical solution temperatures.

**UNIT-IV**

Synthetic Polymers: Preparation, structure, properties (physical, thermal, Flow & Mechanical) and application of the following polymers- polyolefins, polystyrene and styrene copolymers, poly(vinyl chloride) and poly(vinyl acetate), acrylic polymers, fluoro polymers, polyamides, Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes, polycarbonates, conducting polymers [polyacetylene, polyaniline, poly(p-phenylenesulphidepolypyrrole, polythiophene)].

**E-Resources:**

- https://www.vssut.ac.in/lecture_notes/lecture1541230922.pdf
- https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SCY1616.pdf

**Suggested Readings:**


- Seymour, R.B. &Carraher, C.E. *Polymer Chemistry: An Introduction*, Marcel Dekker, Inc. New York, 1981.
- Odian, G. *Principles of Polymerization*, 4th Ed. Wiley, 2004.
- Billmeyer, F.W. *Textbook of Polymer Science*, 2nd Ed. Wiley Interscience, 1971.
- Ghosh, P. *Polymer Science & Technology*, Tata McGraw-Hill Education, 1991.
- Lenz, R.W. *Organic Chemistry of Synthetic High Polymers.* Interscience Publishers.


**Elective Practical:**

**Credit of the Course: 1**

Synthesis of Polymers

a) Preparation of nylon 66 or nylon 6
b) Preparation and purification of IPC (isophthaloyl chloride)
c) Preparation of polyester from (IPC) and phenolphthalein

**E-Resources:**

- https://ia800206.us.archive.org/19/items/TextbookOfPracticalOrganicChemistry5thEd/VogelPracticalOrganicChemistry5thEditionnewfoundV_text.pdf
- https://nie.lk/pdffiles/other/eALOM%20Chemistry%20Practical%20Handbook.pdf

**Suggested Readings:**


- M.P. Stevens, *Polymer Chemistry: An Introduction*, 3rd Ed., Oxford University Press, 1999.
- H.R. Allcock, F.W. Lampe & J.E. Mark, *Contemporary Polymer Chemistry*, 3rd ed.Prentice- Hall (2003)
- F.W. Billmeyer, *Textbook of Polymer Science*, 3rd ed. Wiley-Interscience (1984)
- J.R. Fried, *Polymer Science and Technology*, 2nd ed. Prentice-Hall (2003)
- P. Munk& T.M. Aminabhavi, *Introduction to Macromolecular Science*, 2nd ed. JohnWiley & Sons (2002)
- L. H. Sperling, *Introduction to Physical Polymer Science*, 4th ed. John Wiley &Sons(2005)
- M.P. Stevens, *Polymer Chemistry: An Introduction* 3rd ed. Oxford University Press (2005).
- Seymour/ Carraher's Polymer Chemistry, 9th ed. by Charles E. Carraher, Jr. (2013).


**DECC-601 B: Analytical Clinical Biochemistry**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes:** By the end of this course, students will be able to –

- Perform a wide range of clinical biochemistry laboratory techniques accurately and safely, including sample preparation, analysis, and data interpretation.
- Develop the ability to interpret clinical data, including blood chemistry profiles and other diagnostic tests, to identify and understand the physiological and pathological implications.
- Apply quality assurance and quality control principles in the clinical laboratory to ensure the reliability and accuracy of test results.
- Provide evidence-based recommendations and clinical decision support by integrating biochemistry findings with patient information and medical history.
- Understand the ethical and regulatory considerations in clinical biochemistry, including patient confidentiality and compliance with industry standards and regulations.
- Develop effective communication skills to convey laboratory findings to healthcare professionals and patients in a clear and comprehensible manner, ensuring accurate patient care and management.

**UNIT-I**

Basic understanding of the structures, properties and functions of carbohydrates, lipids and proteins: Review of concepts studied in the core course

Carbohydrates: Biological importance of carbohydrates, Metabolism, Cellular currency of energy (ATP), Glycolysis, Alcoholic and Lactic acid fermentations, Krebs cycle, Isolation and characterization of polysachharides.

Proteins: Classification, biological importance; Primary and secondary and tertiary structures of proteins:α -helixβ and - pleated sheets, Isolation, characterization, denaturation of proteins.

**UNIT-II**

Enzymes: Nomenclature, Characteristics (mention of Ribozymes), Classification, Active site, Mechanism of enzyme action, Stereospecificity of enzymes, Coenzymes and cofactors, Enzyme inhibitors, Introduction to Biocatalysis: Importance in ―Green Chemistry‖ and Chemical Industry.

Lipids: Classification, Biological importance of triglycerides, phosphoglycerides and cholesterol, Lipid membrane, Liposomes and their biological functions and underlying applications.

**UNIT-III**

Lipoproteins: Properties, functions and biochemical functions of steroid hormones. Biochemistry of peptide hormones, Structure of DNA (Watson-Crick model) and RNA, Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation, Introduction to Gene therapy. Enzymes: Nomenclature, classification, effect of pH, temperature on enzyme activity, enzyme inhibition.

**UNIT-IV**

Biochemistry of disease: A diagnostic approach by blood/ urine analysis. Blood: Composition and functions of blood, blood coagulation, Blood collection and preservation of samples, Anaemia, Regulation, estimation and interpretation of data for blood sugar, urea, creatinine, cholesterol and bilirubin.

Urine: Collection and preservation of samples, Formation of urine, Composition and estimation of constituents of normal and pathological urine.

**Elective Practicals**

**Credit of the Course**: 1

1. Identification and estimation of the following:
    - Carbohydrates – qualitative and quantitative.
    - Lipids – qualitative.
    - Determination of the iodine number of oil.
    - Determination of the saponification number of oil.

**Suggested Readings:**

- T.G. Cooper: Tool of Biochemistry.
- Keith Wilson and John Walker: Practical Biochemistry.
- Alan H Gowenlock: Varley's Practical Clinical Biochemistry.
- Thomas M. Devlin: Textbook of Biochemistry.
- Jeremy M. Berg, John L Tymoczko, Lubert Stryer: Biochemistry.
- G. P. Talwar and M Srivastava: Textbook of Biochemistry and Human Biology.
- A.L. Lehninger: Biochemistry.
- O. Mikes, R.A. Chalmers: Laboratory Handbook of Chromatographic Method

**DECM-601 A: Functional Analysis**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |

| | | | |
|---|---|---|---|
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Functional Analysis (Elective-II)**

**Course Learning Outcomes:** After completion of this course the student will be able to:

i) Understand the basic concepts of metric spaces;
ii) Correlate these concepts to their counter parts in real analysis;
iii) Appreciate the abstractness of the concepts such as open balls, closed balls, compactness, connectedness etc. beyond their geometrical imaginations.

**UNIT-I**

Metric spaces: Definition and examples, Sequences in metric spaces, Cauchy sequences, Complete metric space, Open and closed ball, Neighborhood, Open set, Interior of a set, limit point of a set, derived set, closed set, closure of a set, diameter of a set, Subspaces, Dense set.

**UNIT-II**

Continuity & Uniform Continuity in Metric Spaces: Continuous mappings, Sequential criterion and other characterizations of continuity, Uniform continuity, Homeomorphism, Contraction mapping, Banach fixed point theorem, Connectedness and Compactness.

**UNIT-III**

Normed linear spaces, Examples and properties, Equivalent norms, Convexity and completeness, Banach spaces, Examples and properties, l^p spaces, Function space, Quotient Space, Operators on normed linear space, Continuous linear transformations, Bounded linear transformations,

**UNIT-IV**

The open mapping Theorem, The closed graph theorem, The conjugate of an operator, The uniform boundedness principle, Hahn Banach Theorem, Inner product spaces, Hilbert spaces, Orthogonality, Orthogonal complements, Orthogonal Projection on Hilbert spaces, Projection theorem, Bessel's inequality.

**Recommended Readings:**


- Malik S. C. and Arora S, 2017, Mathematical Analysis, New Age Int. Ltd. Publishers, New Delhi.
- Mapa, S.K., 2019, Introduction to Real Analysis, Levant Books, Kolkata.
- Bachman G. and Narici, 1964, Functional Analysis, Academic Press.
- Simmons G. F., 1963, Topology and Modern Analysis, McGraw Hill.
- Erwin Kreyszig E., 1978, Introductory Functional Analysis with Application, Wiley
- Kumaresan, S. (2014). Topology of Metric Spaces (2nd ed.). Narosa Publishing House. New Delhi.


**DECM-601 B: Linear Programming and Application**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.

- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Linear Programming and Applications (Elective-II)**
**Course Learning Outcomes:** After completion of this course the student will be able to:

i) Analyze and solve linear programming models of real life situations.
ii) The graphical solution of LPP with only two variables, and illustrate the concept of convex set and extreme points. The theory of the simplex method is developed.
iii) The relationships between the primal and dual problems and their solutions with applications to transportation, assignment and two-person zero-sum game problem.

**UNIT I**

The Linear Programming Problem**:** Standard, Canonical and matrix forms, Graphical solution. Hyperplanes, Extreme points, Convex and polyhedral sets. Basic solutions; Basic Feasible Solutions; Reduction of any feasible solution to a basic feasible solution; Correspondence between basic feasible solutions and extreme points.

**UNIT II**

Simplex Method**:** Optimal solution, Termination criteria for optimal solution of the Linear Programming Problem, Unique and alternate optimal solutions, Unboundedness; Simplex Algorithm and its Tableau Format; Artificial variables, Two-phase method, Big-M method.

**UNIT III**

Motivation and Formulation of Dual problem; Primal-Dual relationships; Fundamental Theorem of Duality; Complimentary Slackness.

**UNIT IV**

*Transportation Problem***:** Definition and formulation; Methods of finding initial basic feasible solutions; North West corner rule. Least cost method; Vogel's Approximation method; Algorithm for solving Transportation Problem.
*Assignment Problem***:** Mathematical formulation and Hungarian method of solving.

**Recommended Readings:**


- Bazaraa, Mokhtar S., Jarvis, John J., & Sherali, Hanif D. (2010). *Linear Programming and Network Flows* (4th ed.). John Wiley and Sons.
- Hadley, G. (1997). *Linear Programming*. Narosa Publishing House. New Delhi.
- Taha, Hamdy A. (2010). *Operations Research*: *An Introduction* (9th ed.). Pearson.

**DECP-601 A: Fundamentals of Astrophysics**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** Student teachers will be able to:

- Define astronomical Coordinates and H-R Diagram of Clusters.
- Discuss fundamentals of astrophysics and physics of stars.
- Explain the Physical Characteristics of sun.
- Discuss features of Aditya L-1, Chandrayaan-3 mission and extragalactic astrophysics.

**UNIT-I**

Observational Data: Astronomical Coordinates- Celestial Sphere, Horizon, Equatorial, Ecliptic and Galactic Systems of Coordinates, Conversion from one system of co-ordinates to another, Magnitude Scale- Apparent and absolute magnitude, distance modulus. Determination of mass, luminosity, radius, temperature and distance of a star, Colour Index, Stellar classification – Henry-Draper and modern M-K Classification schemes, H-R Diagram, H-R Diagram of Clusters, Empirical mass- luminosity relation.

**UNIT-II**

Physics of Stars: Star formation, stellar evolution from pre-main sequence throughthe main sequence,binaries, clusters.Final stages of stellar evolution and stellar remnant:giants, white dwarfs, supernovae, neutron stars, pulsars, blackholes.

**UNIT-III**

Sun: Physical Characteristics of sun- basic data, solar rotation, solar magnetic fields, Photosphere - granulation, sunspots, Babcock model of sunspot formation, solar atmosphere, Chromosphere and Corona, Solar activity- flares, prominences, solar wind, activity cycle, Helioseismology, exploration of Sun by Aditya L-1.

**UNIT-IV**

Extragalactic Astrophysics: Introduction, Normal galaxies, Morphological classification, Physical characteristics and kinematics, Expansion of the Universe, Active galaxies, Superluminal motion in quasars, Black hole as central engine, Unification scheme, Clusters of galaxies, Gamma ray bursts

**Project:**

- Computational Stellar Evolution
- Distances to the Remnants of Recent Supernova Explosions in the Milky Way
- Exploring the Connection Between Galaxies and Their Central Black Holes
- Fundamental Astronomy of Cataclysmic Binaries
- High Altitude Aerial Platforms for Astronomical Research

**Suggested Readings:**


- Astronomy, The Evolving Universe, M. Zeilik (Cambridge University Press, 2002).
- Introduction to Astronomy & Cosmology, I. Morrison (Wiley, 2008).
- Telescopes and Techniques, C. R. Kitchin (Springer, 1995).
- Astronomical Photometry, A. A. Henden& R. H. Kaitchuk (Willmann-Bell, 1990).
- An Introduction to Astronomical Photometry, E. Budding (Cambridge University Press, 1993).
- Universe, R. A. Freedman & W. J. Kaufmann (W. H. Freeman & Co., 2008).
- Fundamental Astronomy, H. Karttunen et al. (Springer, 2003).
- Solar Astrophysics, P. V. Foukal (Wiley-VCH, 2004).
- Fundamentals of Solar Astronomy, A. Bhatnagar& W.C. Livingston (World Scientific, 2005).


**DECP-601 B: Atmospheric Physics**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** Student teachers will be able to:

- Discuss the characteristics of earth's atmosphere and also its dynamics.
- Explain Thermodynamics of atmosphere and applications of basic equations.
- Apply the concepts of atmospheric Radar and Lidar.

**UNIT-I**

General features of Earth's atmosphere: Thermal structure of the Earth's Atmosphere, Composition of atmosphere, Hydrostatic equation, Potential temperature, Atmospheric Thermodynamics, Greenhouse effect, Local winds, monsoons, fogs, clouds, precipitation, Atmospheric boundary layer, Sea breeze and land breeze, Instruments for meteorological observations including RS/RW, meteorological processes and convective systems, fronts, Cyclones and anticyclones, thunderstorms.

**UNIT-II**

Atmospheric Dynamics: Scale analysis, Fundamental forces, Basic conservation laws, The Vectorial form of the momentum equation in rotating coordinate system, scale analysis of equation of motion, Applications of the basic equations, Circulations and vorticity, Atmospheric oscillations, Quasi biennial oscillation, annual and semi-annual oscillations, Mesoscale circulations, The general circulations, Tropical dynamics.

**UNIT-III**

Thermodynamics of Atmosphere: Humidity variables, moist air, adiabatic expansion of unsaturated air, various lapse rates, vertical mixing, vertical stability of atmosphere, use of thermodynamic diagrams, role of convective potential energy

**Project**

*Scilab/C++ based simulations experiments based on Atmospheric Physics problems like (at least 05 experiments)*

- Numerical Simulation for atmospheric waves using dispersion relations (a) Atmospheric gravity waves (AGW) (b) Kelvin waves (c) Rossby waves, and mountain waves
- Offline and online processing of radar data (a) VHF radar, (b) X-band radar, and (c) UHF radar
- Offline and online processing of LIDAR data
- Radiosonde data and its interpretation in terms of atmospheric parameters using vertical profiles in different regions of the globe.
- Handling of satellite data and plotting of atmospheric parameters using radio occultation technique
- Time series analysis of temperature using long term data over metropolitan cities in India – an approach to understand the climate change
- PM 2.5 measurement using compact instruments
- Field visits to National center for medium range weather forecasting, India meteorological departments, and ARIES Nainital to see onsite radiosonde balloon launch, simulation on computers and radar operations on real time basis

**Suggested Readings:**


- Fundamental of Atmospheric Physics, M.L Salby; Academic Press, Vol 61, 1996.
- The Physics of Atmosphere – John T. Houghton; Cambridge University press; 3rd edition, 2002.
- An Introduction to dynamic meteorology – James R Holton; Academic Press, 2004.
- Radar for meteorological and atmospheric observations – S Fukao and K Hamazu, Springer Japan, 2014.


**DECZ-601 A: Aqua Culture**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.

- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:**

- The learners will be aware of all the techniques involve in aqua culture.
- To get a detailed information about aqua culture.
- To provide a basic idea about the importance of live feed in culture system.

At the end of the course, students can able to gain the knowledge on the aqua culture practices.

**UNIT-I**

a) Aquatic Biomes brief introduction of the aquatic biomes: Freshwater ecosystem (lakes, wetlands, streams and rivers), Estuaries, intertidal zones, Oceanic pelagic zone, Marine benthic zone and Coral reefs.
b) Freshwater Biology Lakes: Origin and classification, Lake as an Ecosystem, Lake morphometry, Physico–chemical Characteristics: Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity; dissolved gases (Oxygen, Carbon dioxide). Nutrient Cycles in Lakes-Nitrogen, Sulphur and Phosphorous.
c) Streams: Different stages of stream development, Physico-chemical environment, Adaptation of hill-stream fishes. Marine Biology Salinity and density of Sea water, Continental shelf, Adaptations of deep sea organisms, Coral reefs, Sea weeds.

**UNIT-II**

a) Management of Aquatic Resources, Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills, Eutrophication, Management and conservation (legislations), Sewage treatment Water quality assessment- BOD and COD.

**UNIT-III**

a) Sustainable Aquaculture; Extensive, semi-intensive and intensive culture of fish; Pen and cage culture; Polyculture; Composite fish culture; Brood stock management; Induced breeding of fish; Management of finfish hatcheries; Preparation and maintenance of fish aquarium; Preparation of compound diets for fish;
b) Role of water quality in aquaculture; Fish diseases: Bacterial, viral and parasitic; Preservation and processing of harvested fish, Fishery by-products Transgenic fish, Zebrafish as a model organism in research

**UNIT-IV**

a) Introduction to Aquarium Fish Keeping; The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes

b) Biology of Aquarium Fishes Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish
c) Food and feeding of Aquarium fishes Use of live fish feed organisms. Preparation and composition of formulated fish feeds
d) Fish Transportation; Live fish transport - Fish handling, packing and forwarding techniques.
e) Maintenance of Aquarium budget for setting up, an Aquarium Fish Farm as a Cottage Industry

**Practical:**

- Study of *Petromyzon, Myxine, Pristis, Chimaera, Exocoetus, Hippocampus, Gambusia, Labeo, Heteropneustes, Anabas*
- Study of different types of scales (through permanent slides/ photographs).
- Study of crafts and gears used in Fisheries
- Water quality criteria for Aquaculture: Assessment of pH, conductivity, Total solids, Total dissolved solids
- Study of air breathing organs in *Channa, Heteropneustes, Anabas* and *Clarias*
- Demonstration of induced breeding in Fishes (video)
- Demonstration of parental care in fishes (video)
- Project Report on a visit to any fish farm/ pisciculture unit/Zebrafish rearing Lab.
- Determine the amount of Turbidity/transparency, Dissolved Oxygen, Free Carbon dioxide, Alkalinity (carbonates & bicarbonates) in water collected from a nearby lake/ water body.
- Instruments used in limnology (Secchi disc, Van Dorn Bottle, Conductivity meter, Turbidity meter, PONAR grab sampler) and their significance.
- A Project Report on a visit to Sewage treatment plant/Marine bio-reserve/Fisheries Institutes.

**Suggested Readings:**


- Q Bone and R Moore, Biology of Fishes, Talyor and Francis Group, CRC Press, U.K.
- D. H. Evans and J. D. Claiborne, The Physiology of Fishes, Taylor and Francis Group, CRC Press, UK
- von der Emde, R.J. Mogdans and B.G. Kapoor. The Senses of Fish: Adaptations for the Reception of Natural Stimuli, Springer, Netherlands
- C.B.L. Srivastava, Fish Biology, Narendra Publishing House
- J.R. Norman, A history of Fishes, Hill and Wang Publishers
- S.S. Khanna and H.R. Singh, A text book of Fish Biology and Fisheries, Narendra Publishing House
- Anathakrishnan: Bioresources Ecology 3rd Edition
- Goldman : Limnology, 2nd Edition
- Odum and Barrett : Fundamentals of Ecology, 5th Edition
- Pawlowski: Physicochemical Methods for Water and Wastewater Treatment, 1st Edition
- Wetzel : Limnology, 3rd edition
- Trivedi and Goyal : Chemical and biological methods for water pollution studies
- Welch : Limnology Vols. I-II


## DECZ-601 B: Poultry Farming

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.

- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:**

- Know about poultry production in India.
- Know the fowl, its classification and principle behind poultry breeding
- Understand the management of chicks, growers, layers.
- Understand the poultry nutrition and feeding of poultry etc.
- Understand poultry disease and the centres of disease.
- To develop entrepreniual skills in poultry farming.

**UNIT-I**

a) Development of Poultry Industry and Poultry Production in India
b) Genetic classification of Poultry, Origin and breed characteristics of poultry, Biology of Fowl
c) Mendel's laws of inheritance related to poultry, Qualitative and Quantitative traits in Poultry breeding, Additive, Non-additive,
d) Epistatic and complementary gene action, Lethal and other mutations in poultry, Sex linked, Sex limited and Sex influenced traits, Heritability, epigenetic inheritance
e) Incubation Practices, Systems of Rearing Poultry, Housing and Equipments
    a. A case study on Nutrient requirements, Feed ingredients, feed consumption, feed storage technique in poultry

**UNIT-II**

a) Assessment of Factors affecting inheritance of qualitative and quantitative traits in poultry
b) Different systems of breeding, selection methods
    a. Design and implementation of breeding programme in developing egg-type and meat type birds

**UNIT-III**

a) Commercial Layer production and their management
b) Commercial Broiler Production and their management
c) Physical and chemical composition and nutritive value of eggs and meat
d) Assignment on management of chicks, growers, layer, breeding stock and broilers in nearby poultry farm.
e) Report on processing, preservation and quality control of eggs and poultry meat

**UNIT-IV**

a) Modern tools in poultry breeding
b) Conservation of poultry genetic resources.
c) Main Diseases of Poultry, Prevention and Control and Poultry Diseases
d) Biosecurity, health management, vaccination and waste disposal

e) Understanding of key provisions of National Livestock Mission, Animal Husbandry Infrastructure Development Fund (AHIDF), Poultry Entrepreneurship Development Program in Rajasthan, The Rajasthan Land Revenue (Allotment of Land to Dairy, Poultry & Piggery Farms) Rules, 1958.
f) A case study on Sanitation, fumigation and phyto-sanitary measures to ensure food safety in poultry production

**Practical:**

- Identification of Breeds of Chicken, Ducks & Geese, Turkeys, Quails, Guinea
- Fowls and Desi Chicken)
- Life Cycle studies of common poultry birds
- Poultry farm layout planning
- Feed preparation for poultry birds
- Sexing of Individual
- Candling of Egg.
- Studies of Permanent Slides: T.S. of Intestine, T.S. of Liver, T.S. of Pancreas,
- T.S. of Ovary, T.S. of Testis; 18hrs, 24hrs, 36hrs, 48hrs, 72hrs, 96hrs and 120hrs of incubation.
- Use of Feathers

**Suggested Readings:**


- N. Ghosh. Poultry Science and Practice.
- J. Prasad. Poultry production and management.
- Sreenivasaiah, P.V. 2015. Textbook of Poultry Science. 1 st Edition. Write & Print Publications, New Delhi
- Jull, A. Morley. 2007. Successful Poultry Management. 2 nd Edition. Biotech Books, New Delhi & quot;
- Hurd, M. Louis, 2003. Modern Poultry Farming. 1 st Edition. International Book Distributing Company, Lucknow."
- http://www.asci-india.com/BooksPDF/Small%20Poultry%20Farmer.pdf
- https://nsdcindia.org/sites/default/files/MC_AGR-Q4306_Small-poultry-farmer-.pdf
- http://ecoursesonline.iasri.res.in/course/view.php?id=335


## DCSC-601: Organic Farming

| | |
|---|---|
| Credits: 2L+0T+1P | Marks 75 |
| Contact hours per week: 4 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |

| | | | |
|---|---|---|---|
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |
| **Total Marks** | 75 | | 30 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes**: By the end of this course, students will be able to –

1. Know the different types of fertilizers.
2. The significance of nutrients for crops.
3. Process of basic concepts of organic farming.
4. differentiate organic and synthetic fertilizers.

**UNIT-I**

Chemical Fertilizer. Advantage & Disadvantage of their use:
Nutrient content of different fertilizers
Balanced Nutrients supply:
a) For Organic Farming system using nutrients from Organic sources.
b) Integrated plant nutrient Management

Types of Farming (Advantage & disadvantage of each system):
Pure Organic Farming – Definition, Concept & Benefits
Integrated Farming system (Combination of Organic and Inorganic), Mixed Farming

**UNIT-II**

Concept of different cropping systems in relation to Organic Farming (Inter cropping etc)
Organic Farming (Process), Concept of farming system, developing organic farms, important steps & methods

Plant Nutrients:
Name of plant Nutrients with gradation
Functions of Nutrients in plant growth and Development of crops
Nutrient uptake and Utilization by plant:
From Organics
From Inorganic

**UNIT-III**

Sources of nutrients for Organic farming:
Organic Manure –
FYM/Rural compost, City compost, Oil cakes,
Animal wastes, Vermi composts, etc
Characterization and Nutrients content of the above sources (Data Chart)
Green Manure –
Green Manure with Leguminous crops in crop rotation. In-situ incorporation of crop residues -Benefits
Other Nitrogen contributing plants.
Liquid Manure

**UNIT-IV**

Importance of Bio fertilizers in soil productivity
Nitrogenous
Phosphatic
Potassic
Importance of Neem in organic farming
Quality Control and certification procedures of Organic products

**Suggested readings:**


- Sharma, Arun K. 2002. A Handbook of Organic farming. Agrobios, India.
- Sathe, T.V. 2004, Vermiculture and Organic Farming. Daya Publishers.
- Gupta, M., 2004. Organic Agriculture Development in India. ABD publishers, Jaipur, India.
- S.P. Palaniappan, K. Annadurai, 1999. Organic Farming- Theory and Practice, Scientific Publishers, Jodhpur, India.
- 7. Organic Farming: The Ecological System- Agronomy Monograph 54, ASA, USA.
- 11. Dushyent Gehlot. 2005. Organic Farming- standards, accreditation, certification and inspection. Agribios, India.


**PRACTICALS**

**Soil:**

Soil and its physical characters.
Soil types:- Alluvial, Laterite, Clay, Loam etc.
Physical testing and assessment of soil types, weighment, water movement etc.
Preparation of FYM/Rural Compost / Different types of composting
Preparation of compost pit at appropriate location
Lining of pit with brick, polythene sheet
Collection and accumulation of raw materials
Aerated/Non aerated pits for quality manure production
Collection or rotten manure and post treatment

## DCSC-602: Instrumental Methods of Chemical Analysis

| | |
|---|---|
| Credits: 2L+0T+1P | Marks 75 |
| Contact hours per week: 4 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |
| **Total Marks** | 75 | | 30 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcomes:** By the end of this course, students will be able to –

- Apply the concept of separation process for various phenomenon related to day to day life.
- Analyze the composition of molecules using different spectral techniques.

**UNIT-I**

Introduction to spectroscopic methods of analysis:

Recap of the spectroscopic methods covered in detail in the core chemistry syllabus: Treatment of analytical data, including error analysis, Classification of analytical methods and the types of instrumental methods, Consideration of electromagnetic radiation.

Infrared spectroscopy: Interactions with molecules: absorption and scattering, Means of excitation (light sources), separation of spectrum (wavelength dispersion, time resolution), detection of the signal (heat, differential detection), interpretation of spectrum (qualitative, mixtures, resolution), advantages of Fourier Transform (FTIR). Samples and results expected. Applications: Issues of quality assurance and quality control, Special problems for portable instrumentation and rapid detection.

**UNIT-II**

UV-Visible/ Near IR – emission, absorption, fluorescence and photoaccoustic, Excitation sources (lasers, time resolution), wavelength dispersion (gratings, prisms, interference filters, laser, placement of sample relative to dispersion, resolution), Detection of signal (photocells, photomultipliers, diode arrays, sensitivity and S/N), Single and Double Beam instruments, Interpretation (quantification, mixtures, absorption vs. fluorescence and the use of time, photoaccoustic, fluorescent tags).

**UNIT-III**

Separation techniques

Chromatography: Gas chromatography, liquid chromatography, supercritical fluids, Importance of column technology (packing, capillaries), Separation based on increasing number of factors (volatility, solubility, interactions with stationary phase, size, electrical field), Detection: simple vs. specific (gas and liquid), Detection as a means of further analysis (use of tags and coupling to IR and MS), Electrophoresis (plates and capillary) and use with DNA analysis, Immunoassays and DNA techniques

Mass spectroscopy: Making the gaseous molecule into an ion (electron impact, chemical ionization), Making liquids and solids into ions (electrospray, electrical discharge, laser desorption, fast atom bombardment), Separation of ions on basis of mass to charge ratio, Magnetic, Time of flight, Electric quadrupole, Resolution, time and multiple separations, Detection and interpretation (how this is linked to excitation).

**UNIT-IV**

Elemental analysis:

Mass spectrometry (electrical discharges)

Atomic spectroscopy: Atomic absorption, Atomic emission, and Atomic fluorescence, Excitation and getting sample into gas phase (flames, electrical discharges, plasmas), Wavelength separation and resolution (dependence on technique), Detection of radiation (simultaneous/scanning, signal noise), Interpretation (errors due to molecular and ionic species, matrix effects, other interferences).

NMR spectroscopy: Principle, Instrumentation, Factors affecting chemical shift, Spincoupling, Applications.

Electroanalytical Methods: Potentiometry & Voltammetry, Radiochemical Methods, X-ray analysis and electron spectroscopy (surface analysis)

**Suggested Readings:**


- Principles of Instrumental Analysis - 6th Edition by Douglas A. Skoog, F. James Holler, and Stanley Crouch (ISBN 0-495-01201-7).
- Instrumental Methods of Analysis, 7th ed, Willard, Merritt, Dean, Settle.
- P.W. Atkins: Physical Chemistry.
- G.W. Castellan: Physical Chemistry.
- C.N. Banwell: Fundamentals of Molecular Spectroscopy.
- Brian Smith: Infrared Spectral Interpretations: A Systematic Approach.
- W.J. Moore: Physical Chemistry.

**DCSC-603: Numerical Analysis**

| | |
|---|---|
| Credits: 2L+1T+0P | Marks 75 |
| Contact hours per week: 4 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |
| **Total Marks** | 75 | | 30 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Numerical Analysis (Skill Enhancement Course)**

**Course Learning Outcomes:** After completion of this course the student will be able to:
i) Some numerical methods to find the zeroes of nonlinear functions of a single variable and solution of a system of linear equations, up to a certain given level of precision.
ii) Interpolation techniques to compute the values for a tabulated function at points not in the table.
iii) Applications of numerical differentiation and integration to convert differential equations into difference equations for numerical solutions.

**UNIT-I**

Methods for Solving Algebraic and Transcendental Equations: Algorithms, Convergence, Bisection method, False position method, Fixed point iteration method, Newton's method, Secant method

**UNIT-II**

Techniques to Solve Linear Systems: Partial and scaled partial pivoting, LU decomposition and its applications, Iterative methods: Gauss-Jacobi, Gauss-Seidel and SOR methods.

**UNIT-III**

Interpolation: Lagrange and Newton interpolation, Piecewise linear interpolation.

**UNIT-IV**

Numerical Differentiation and Integration: First order and higher order approximation for first derivative, Approximation for second derivative. Numerical integration by closed Newton-Cotes formula: trapezoidal rule, Simpson's rule and its error analysis. Euler's method to solve ODE's.

**Recommended Readings:**


- Bradie, Brian. (2006). A Friendly Introduction to Numerical Analysis. Pearson Education, India. Dorling Kindersley (India) Pvt. Ltd. Third impression 2011.
- Jain, M. K., Iyengar, S. R. K., & Jain, R. K. (2012). Numerical Methods for Scientific and Engineering Computation. (6th ed.). New Age International Publisher, India, 2016.
- Gerald, C. F., & Wheatley, P. O. (2008). Applied Numerical Analysis (7th ed.). Pearson Education. India.


**DCSC-604: Electricity and Electronics**

| | |
|---|---|
| Credits: 2L+0T+1P | Marks 75 |
| Contact hours per week: 4 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |
| **Total Marks** | 75 | | 30 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** On completion of the course the student teacher will be able to

- Recognize and use different soldering methods.
- Explain working of different lamps.
- Acquire skill to assemble/prepare simple electrical appliances.
- Develop the ability in repairing simple appliances used at secondary level.
- Develop the skills for making simple projects/models.
- Create healthy work culture and values.

**UNIT-I**

Knowledge of different soldering methods like wave soldering, dip soldering and ultra-sonic soldering, Practice of soldering.

Understanding the working of CFL tubes, Incondescent lamp, arc lamp, sodium vapour lamp, neon lamp, fluorescent lamp, use of choke and starter

**UNIT-II**

Construction of Transformers, recognition of primary and secondary winding, knowledge of step-up and step-down transformer, Use of transformers

**UNIT-III**

Understanding the working of Electrical appliances such as Refrigerator, Air conditioners etc, making Resistance and Capacitance boxes, use of testing board and extension boards for laboratory.

**UNIT-IV**

Recognition of emitter, base and collector in a transistor, characteristics of transistor, transistor action, Amplification by transistor, Basic idea of integrated circuits, FET – recognition of drain, source and gate terminals, FET and its characteristics, testing of transistor and FET, LCD.

**Practical:**

**Project (anyone) - Only suggestive** Alarm for luggage security Mobile cell-phone charger using cell Power supply failure alarm Blown fuse indicator

**Suggested Readings**:

- Electrician – I Year- Trade Theory Published by National Instructional Media Institute, Chennai re-print 2007
- Electrician – II Year - Trade Theory Published by national Instructional Media Institute Chennai re-print 2007 3. Electrical Machinery Published by Krishna Publisher Delhi Author P.S. Bhimbhara re-prints 2007

**Modes of Learning Engagement**: Constructivist Approach: Hands on Experience, Activity used Learning, Experimentation Interactive Engagement, Group work, Peer Learning, Project Work

**DCSC-605: Vermiculture**

| | |
|---|---|
| Credits: 2L+0T+1P | Marks 75 |
| Contact hours per week: 4 | C1+C2=25 |
| External Examination:3hours | C3=50 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 30 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations: Theory | 50 | 3hr | |
| **Total Marks** | 75 | | 30 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**Course Learning Outcome:** After successfully completing the course, the students will be able to:

- Compost in a limited space and describe the decomposing process.
- know of composting, and how such information may used for skill enhancement

- Develop the basic idea about organic farming, and how it helps in maintaining the environment pollution free.
- Appreociate knowledge of biodiversity of local earthworms.

**UNIT-I**

a) Introduction to Vermiculture: Definition, meaning, history, economic important, their value in maintenance of soil structure, role as four R's: Reduce, Reuse, Recycle, Restore.
b) Earthworm's role in bio transformation of the residues generated by human activity and production of organic fertilizers.
c) The matter and humus cycle (product, qualities). Ground population, transformation process in organic matter.
d) Choosing the right worm. Useful species of earthworms. Local species of earthworms. Exotic species of earthworms. Complementary activities of auto evaluation.

**UNIT-II**

a) Biology of *Eisenia fetida*: Taxonomy, Anatomy, physiology and reproduction of Lumbricidae.
b) Vital cycle of *Eisenia fetida*: alimentation, fecundity, annual reproducer potential and limit factors (gases, diet, humidity, temperature, pH, light, and climatic factors). Complementary activities of auto evaluation.
c) Biology of *Eudrilus eugeniae*: Taxonomy, Anatomy, physiology and reproduction of Eudrilidae.
d) Vital cycle of *Eudrilus eugeniae*: alimentation, fecundity, annual reproducer potential and limit factors (gases, diet, humidity, temperature, pH, light, and climatic factors). Complementary activities of auto evaluation.

**UNIT-III**

a) Small Scale Earthworm farming for home gardens - Earthworm compost for home gardens, Conventional commercial composting - Earthworm Composting larger scale
b) Earthworm Farming (Vermiculture), Extraction (harvest), vermicomposting harvest and processing.
c) Nutritional Composition of Vermicompost for plants, comparison with other fertilizers, Vermiwash collection, composition & use
d) Enemies of Earthworms, Sickness and worm's enemies.
e) Frequent problems: How to prevent and fix them, Complementary activities of auto evaluation.

**UNIT-IV**

a) The working group experience with *E. fetida* populations comportment with farm industrial residues (frigorific, cow places, feed-lot, aviaries exploitations, and solid urban residues).
b) Lineaments to vermicomposting elaboration projects.
c) Considerations about economical aspects of this activity. Research and ratability according to different exploitation orientations (worm's meat production, worm's humus production, or integrated projects). Toxins released by the worms (harmful effects) Complementary activities of auto evaluation.

**Practical:**

- Key to identify different types of earthworms
- Field trip- Collection of native earthworms & their identification
- Study of Systematic position, habits, habitat & External characters of *Eisenia fetida*
- Study of Life stages & development of *Eisenia fetida*
- Study of Life stages & development of *Eudrilus eugeniae*
- Comparison of morphology & life stages of *Eisenia fetida* & *Eudrilus eugeniae*
- Study of Vermiculture, Vermiwash & Vermicompost equipments, devices
- Preparation vermibeds, maintenance of vermicompost & climatic conditions.
- Harvesting, packaging, transport and storage of Vermicompost and separation of life stages
- Study of verms diseases & enemies, Study the effects of sewage water on development of worms
- Study the effects of vermicompost & vermiwash on any two short duration crop plants.

**Suggested Readings:**


- Bhatt J.V. & S.R. Khambata (1959) "Role of Earthworms in Agriculture" Indian Council of Agricultural Research, New Delhi
- Dash, M.C., B.K. Senapati, P.C. Mishra (1980) "Verms and Vermicomposting" Proceedings of the National Seminar on Organic Waste Utilization and Vermicomposting Dec. 5-8, 1984, (Part B), School of Life Sciences, Sambalpur University, Jyoti Vihar, Orissa.
- Edwards, C.A. and J.R. Lofty (1977) "Biology of Earthworms" Chapman and Hall Ltd., London.
- Lee, K.E. (1985) "Earthworms: Their ecology and Relationship with Soils and Land Use" Academic Press, Sydney.
- Kevin, A and K.E.Lee (1989) "Earthworm for Gardeners and Fisherman" (CSIRO, Australia, Division of Soils)
- Rahudakar V.B. (2004). Gandul khatashivay Naisargeek Paryay, Atul Book Agency, Pune.
- Satchel, J.E. (1983) "Earthworm Ecology" Chapman Hall, London.
- Wallwork, J.A. (1983) "Earthworm Biology" Edward Arnold (Publishers) Ltd. London.


**PCMA-601: Content cum Pedagogy of Mathematics (CCPM-III)**

| | |
|---|---|
| Credits: 1L+1T+0P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course:**

Development of 21st century skills are important for Mathematics teaching learning. Learning the imagination, spatial visualization, mathematical reasoning is important for novice learners. The course comprises three units describing 21st century skills for learning, assessment and evaluation and research and innovative practices in teaching learning Mathematics. This course also aims to improve skills and competencies required for Mathematics teachers to conduct effective learner assessments. The course describes various evaluation strategies and devices which can be efficiently used in the teaching learning of Mathematics and in the development of skills among the

student teachers for improving student outcomes, conduct action research and school-based research in the teaching of Mathematics.

**Course Learning Outcomes**

After completion of the course, student teachers will be able to:

- analyze the sources of the development of 21st century skills through Mathematics teaching and learning,
- determine role of teacher in facilitating learning and creating dynamic learning environment of Mathematics,
- describe need for and importance of assessment in the learning process of Mathematics,
- develop various types of tests for assessing students learning in Mathematics,
- design and develop innovative strategies and techniques for successful inteaching and learning Mathematics,
- conduct school- based research in Mathematics teaching,
- explain the various methods of exploring knowledge,
- explore innovative ideas for teaching and learning of Mathematics,
- assess the steps of action research.

**UNIT - I**

21st Century Skills for Learning Mathematics

a) Need for and importance of how to learn 21st century skills such as practicing imagination, spatial visualization, mathematical reasoning, problem solving for learners and teachers of Mathematics.
b) Psychological, sociological, and philosophical perspective of teaching learning and development of Mathematics.
c) Qualities of a Mathematics teacher as professional.
d) Role of a teacher in facilitating learning and creating dynamic learning environment of Mathematics.

**UNIT - II**

Assessment for Learning in Mathematics

a) Meaning, need and organization of oral, written, and practical assessment in Mathematics.
b) Construction of types of questions in Mathematics: objective, short answer, long answer, considerations for the marking different types of questions in Mathematics.
c) Planning and developing teachers made tests in Mathematics - Table of Specification (TOS), question paper setting and preparing answer key.
d) Tools to identify learning difficulties and provide corrective measures in Mathematics, concept of $360_o$ assessment, holistic progress card and assessment of mathematical aspects of students.

**UNIT - III**

Research and Innovative Practices in Teaching of Mathematics

a) Divergent thinking for innovation in psychological, sociological, and philosophical perspectives of Mathematics for quality learning experiences.
b) Innovative practices in Mathematics.
c) Research on issues of gender, class and culture in Mathematics learning and achievement-expectations, attitudes and stereotypes; access to higher Mathematics; interrogating the notion of 'Achievement Gap'; construction of learners' identity in a Mathematics classroom.
d) Recent trends and research related to teaching learning of Mathematics – digital gaming, digital storytelling, using Artificial Intelligence for Mathematics teaching and learning.
e) Action research for solving problems of teaching and learning of Mathematics: meaning, significance, steps, and planning.

**Suggestive Practicum (Best out of Two)**

- List 21st century skills with reference to various topics of school Mathematics.
- Writing a paper on recent trends and research related to teaching learning of Mathematics.
- Prepare a scrap book for 'Mathematics in Print Media'.
- Prepare a small video for recent trends of Mathematics in social media.

- Plan a teacher made test for a unit of secondary Mathematics.
- Prepare a report after using an innovative idea to teach a difficult topic of secondary Mathematics.
- Plan for action research on any one problem of teaching learning Mathematics.
- Any other project assigned by HEI.

**Suggestive Mode of Transaction**
Lecture cum discussion, group work, ICT enabled methods, activity based and art integrated demonstration, field-based experiences, library visits, self-study, field observations, assignment preparation, classroom presentations, discussion forums, observation, flip classroom, use of digital platform.
**Suggestive Mode of Assessment**
Written test, classroom presentation, workshop, assignments, practicum, sessional and terminal semester examination.

**Suggestive Reading Material**
- NCERT (2012). Pedagogy of Mathematics
- NCERT: Manual for Higher Secondary Mathematics Kit (Code- 3165)

*Teachers may also suggest books/readings as per the need of the learners and learning content

**PCPS-602: Content cum Pedagogy of Physical Sciences (CCPPS-III)**

| | |
|---|---|
| Credits: 1L+0T+1P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**
This course comprises three units and a practicum. It focuses on assessment and evaluation. It also focuses on assessment based on learning outcomes, strategies for continuous assessment, school-based assessment, formative and summative assessment including 360◦ assessment. Student teachers are expected to identify various concepts

and processes, list learning and behavioral outcomes, find out about various activities and experiments, and identify relevant evaluation techniques and strategies. It focuses on Psychological, Sociological and Philosophical Perspective of Activity Oriented Classrooms in Physical Sciences. The importance of planning science learning and teaching in secondary schools. In this course student teachers will learn how to plan different types of activities in online and offline mode. It emphasizes how to integrate and use ICT in the classroom of Physical Sciences. Assessment serves the dual purpose of tracking the performance of the learners as well as feedback mechanism for effectiveness of teaching. Today's scenario emphasizes competency-based assessment practices and tests higher order thinking skills and conceptual clarity. Major reforms in assessment are need of the hour to stay vibrant and effective in the process of teaching learning of Physical Sciences.

**Course Learning Outcomes**

After completion of this course, student teachers will be able to:

- explain the significance of acquiring 21st-century skills for Physical Sciences teaching,
- outline the need for and importance of assessment and evaluation in the teaching of Physical Sciences,
- appraise with various assessment strategies for continuous assessment in reference to teaching of Physical Sciences,
- utilize appropriate tools and techniques for assessment and evaluation in teaching learning of Physical Sciences,
- identify recent trends in research related to the teaching and learning and its implications in teaching learning of Physical Sciences,
- prepare unit test item based on TOSS and develop different types of test items,
- construct and administer different type of tests,
- plan offline and online activities for testing higher order thinking skills in teaching learning of Physical Sciences,
- relate ICT integration and elaborate its use in classroom situations,
- identify a problem in the context of Physical Sciences teaching learning and plan action research.

**UNIT - I**

21st Century Skills for Learning

a) Need for and importance of how to learn 21st century skills for learners and teachers of Physical Sciences.
b) Psychological, sociological, and philosophical perspective of teaching and learning Physical Sciences.
c) Qualities of a Physical Sciences teacher as professional for enhancing teaching learning skills.
d) Role of a teacher in facilitating learning and creating dynamic learning environment of Physical Sciences.

**UNIT - II**

Assessment and Evaluation

a) Assessment and evaluation: need for and importance of Physical Sciences.
b) Assessment based on learning outcomes, strategies for continuous assessment, school- based assessment, qualitative assessment; formative and summative assessment, formal, informal and 360◦ assessment.
c) Performance assessment: assessment of group activities, field observations, recording and reporting, creating platform and portfolio management, assessment of laboratory skills, assignments, projects, and presentations.
d) Tools and techniques of assessment and evaluation - unit test based on Table of Specification (TOS) and its importance, basic steps of question paper setting, types of test items and preparing answer key and criteria for school, assessment, and feedback mechanism in teaching learning the content of Physical Sciences.

**UNIT - III**

Research and Innovative Practices in Physical Sciences

a) Divergent thinking and innovation in psychological, sociological, and philosophical perspectives for quality learning experiences.
b) Recent trends in research related to teaching learning of Physical Sciences.
c) Action research: meaning, significance, steps and planning.
d) Evidence-based practices and reflection, school-based research in Physical Sciences.

**Suggestive Practicum (Best out of Two)**

- Prepare, administer, and analyze scores of an achievement test.
- Explore AI based assessment tools and prepare an E-Portfolio for a student of Secondary Stage.
- Conduct Simulated Teaching session for the concepts of Physical Sciences and observation by self, peer, and teacher.
- Explore development of multidisciplinary projects and present using PowerPoint.
- Interpret the concept of Physical Sciences with Psychological, Sociological and Philosophical Perspective.
- Apply innovative practices in classroom teaching learning of Physical Sciences.
- Make a presentation on the role of Physical Sciences in sustainable development of society.
- Plan action research for Continuous Professional Development (CPD) of Physical Sciences teacher.
- Any other project assigned by HEI.

**Suggestive Mode of Transaction**
Lecture cum discussion/demonstration, demonstration, discovery approach, project approach, inquiry approach, problem-solving, experiential learning.

**Suggestive Mode of Assessment**
Written test, classroom presentations, workshops, seminars, assignments, practicums, sessional and terminal semester examinations.

**Suggestive Reading Material**
- National Council of Educational Research and Training. (April 2022). Mandate documents Guidelines for the development of National Curriculum Frameworks.
- National Education Policy 2020, MoE, Government of India
- National Steering Committee for National Curriculum Frameworks, (2023). Draft National Curriculum Framework for School Education.

*Teachers may also suggest books/readings as per the need of the learners and learning content.

**PCBS-603: Content cum Pedagogy of Biological Sciences (CCPBS-III)**

| | |
|---|---|
| Credits: 1L+0T+1P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

Assessment and Evaluation are an inseparable component of teaching learning of Biological Sciences. In this course, student teachers will be exposed to various assessment practices that can be followed in assessment of Biological Sciences. The course also deals with planning action research in classroom situations. It focuses on Psychological, Sociological and Philosophical Perspective of Learning of Biological Sciences, The importance of planning science learning and teaching in secondary schools. In this course student teachers will learn how to plan different types of activities in online and offline mode. It emphasizes how to integrate and use ICT in the classroom of Biological Sciences.

**Course Learning Outcomes**

After completion of this course, Student teachers will be able to:

- appraise different types of assessment and strategies for continuous assessment,
- distinguish between assessment and evaluation,
- compare merits and demerits of different types of assessment,
- develop unit test item based on TOS and develop different type of test items,
- construct and administer the achievement test,
- familiarize with basic statistical methods for analyzing performance in tests,
- plan offline and online activity for testing higher order thinking skills,
- recognize challenges in modern day classrooms and plan appropriate strategies,
- relate ICT integration and elaborate its use in classroom situations.

**UNIT - I**

21st Century Skills for Learning

a) Need for and importance of how to learn 21st century skills for learners and teachers of Biological Sciences.
b) Psychological, sociological, and philosophical perspective of teaching and learning Biological Sciences.
c) Qualities of a Biological Sciences teacher as professional for enhancing teaching learning skills.
d) Role of a teacher in facilitating learning and creating dynamic learning environment of Biological Sciences.

**UNIT - II**

Assessment and Evaluation

a) Assessment and evaluation: concept, need for and importance of teaching learning the Biological Sciences.
b) Assessment based on learning outcomes, strategies for continuous assessment, school-based assessment, qualitative assessment; formative and summative assessment, formal, informal, and 360-degree assessment.
c) Performance assessment: assessment of group activities, field observations, recording and reporting, creating platform and portfolio management, assessment of lab skills, assignments, projects, and presentations based on the concepts of Biological Sciences.
d) Unit test based on Table of Specification (TOS) and its importance; basic steps of question paper setting of Biological Sciences, types of test items and preparing answer key and criteria for school, assessment, and feedback mechanism in teaching learning the concepts of physical science at secondary stage.

**UNIT - III**

Research and Innovative Practices in Biological Sciences

a) Divergent thinking and innovation in psychological, sociological, and philosophical perspectives for quality learning experiences, creating a sensitive and conducive classroom environment for learning and practicing life skills.
b) Recent trends in research related to teaching learning of Biological Sciences.
c) Action research: meaning, significance, steps, and planning.
d) Evidence-based practices and reflection, school-based research in Biological Sciences.

**Suggestive Practicum (Best out of Two)**

- Prepare, administer, and analyze scores of an achievement test.
- Explore AI based assessment tools and prepare an E-Portfolio for a student of Secondary Stage.
- Identify a topic and Plan action research at secondary stage.
- Conduct Simulated Teaching session for the concepts of Biological Sciences and observation by self, peer, and teacher.
- Apply innovative practices in classroom teaching learning of Biological Sciences.
- Any other project assigned by HEI.

**Suggestive Mode of Transaction**

Lecture cum discussion, demonstration, Hands-on activities, experiential learning, inquiry, Group work, Presentations, multimedia

**Suggestive Mode of Assessment**

Written tests, classroom presentations, workshops, seminars, assignments, practicums, sessional and terminal semester examinations.

**Suggestive Reading Material**

- National Council of Educational Research and Training. (April 2022). Mandate documents Guidelines for the development of National Curriculum Frameworks.
- National Education Policy 2020, MoE, Government of India.
- National Steering Committee for National Curriculum Frameworks, (2023). Draft National Curriculum Framework for School Education.
- NCERT, Textbooks of Biological Sciences at Secondary Stage.

*Teachers may also suggest books/readings as per the need of the learners and learning content

**AEVA-601: Mathematical & Quantitative Reasoning**

| | |
|---|---|
| Credits: 1L+1T+0P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)

C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

This course introduces the student teachers to study the basic mathematical & quantitative reasoning for their practical usage. This course is designed to provide student teachers with the knowledge and capacities required to analyze, interpret, and communicate quantitative data. Student teachers will learn to think critically about data and use quantitative reasoning to solve real-life problems.

**Course Learning Outcomes**

After completion of this course, student teachers will be able to:

- adapt mathematical reasoning to solve problems in the real world and explain some fundamental ideas and tenets in this field,
- analyze and interpret quantitative data,
- interpret & deduce the right conclusions from numerical representations like formulas, graphs, or tables,
- demonstrate critical thinking and problem-solving skills using mathematical and quantitative reasoning methods,
- evaluate operational matrix,
- analyze educational data and create educational model & use them in decision making,
- analyze and evaluate mathematical and quantitative reasoning problems and solutions.

**UNIT - I**

Introduction to mathematical and quantitative reasoning

a) Meaning, nature and scope of mathematical and quantitative reasoning.
b) Importance of mathematical and quantitative reasoning in various fields.
c) Types of quantitative reasoning.
d) Usage of mathematical and quantitative reasoning.
e) Concept of mathematization.

**UNIT - II**

Introduction to data in Education

a) Data requirement, different sources of data
b) School enrolment: gross enrolment ratios, net enrolment ratios, educational progression: dropout rate, literacy: measures of literacy
c) Indian censuses, details of different items on which Indian censuses collect data.
d) Nationwide sample surveys, National family health survey, District level household survey, UDISE

**UNIT - III**

Data Analysis & Interpretation

a) Concept of data interpretation (equation, diagram, graph, tables)
b) Statistical analysis of data in educational context and its applications (measures of central tendency, measures of variability, percentile)
c) Visual and numerical representation of data and its application (bar diagram, histogram, pie charts)
d) Learning analytics: concept, significance, types, levels, and its applications in educational context.

**Suggestive Practicum**

Take last 5 years of UDISE data and analyze various indicators related to schools, teachers, and students.

**Suggestive Mode of Transaction**

The approaches to curriculum transaction will focus on developing the analytical and critical thinking skills of students, as well as their ability to apply mathematical and quantitative reasoning in real-life situations. Some of the approaches to curriculum transaction will include the following:

- Active Learning which involves active participation of student teachers in problem-solvingsituations, group discussions, and hands-on activities that help student teachers engage with the material and apply mathematical thinking and reasoning to solve problems.

- Real-World Applications involving the use of real-world examples to demonstrate the practical applications of mathematical concepts that help student teachers see the relevance of what they are learning and how it can be applied in various fields.
- Collaborative learning encourages student teachers to work together in small groups, where they can share ideas and help each other learn. This fosters a sense of community in the classroom and helps students develop teamwork and communication skills.
- Technology Integration involves the incorporation of technology tools such as calculators, spreadsheets, and interactive software to help student teachers visualize and solve mathematical problems more easily.
- Overall, a pedagogy that combines active learning, real-world applications, collaborative learning, technology integration, and effective assessment strategies that help student teachers develop a strong foundation in mathematical and quantitative reasoning.

**Suggestive Mode of Assessment**
Use of a variety of assessment methods such as quizzes, exams, group projects, and presentations to evaluate student learning Providing timely feedback and offering opportunities for students to revise their work and improve their understanding.

**Suggested Reading Materials**
Teachers may suggest books/readings as per the need of the learners and learning content.

**EDSE-601: School Observations (Field Practice)**

| | |
|---|---|
| Credits: 1L+0T+1P | Marks 50 |
| Contact hours per week: 3 | |
| Internal Evaluation (field practice will be conducted by TEI in Schools) | 50 |

| Paper | Max.Marks | Min. Pass Marks |
|---|---|---|
| Internal Evaluation | 50 | 20 |
| **Total Marks** | 50 | |

**About the Course**
As school is the heart of the teacher education programme, the student teachers need to gain hands-on experiences from various activities organized by the school. School observation offers an opportunity to learn the processes and practices in a school setup. To expose the student teachers to various schooling systems (urban, rural, tribal, residential, non-residential, government, private, affiliated to different school boards like Central Board, State Board, International Board) prevailing in the country. School observation will also prepare the student teachers to build relationships with various stakeholders. The school observation by the student teachers is aimed at helping them build perspective in the schooling system, student needs, pedagogies, and assessment.

**Suggestive Structure**
ITEP 6th semester has a School Observation (Field Practice) for a period of 3 weeks where student teachers need to gain hands on experiences from various activities organised by schools. ITEP institute can choose suitable option based on their context:
- One week at ITEP Institute.
- Two weeks in School.

**Course Learning Objectives**
After completion of school observation program, student teachers will be able to:
- get acquainted with various schooling systems.
- experience the processes, practices, and overall environment of the school.
- establish a rapport with all the stakeholders of the school system.
- observe the process of conducting different activities in the school.

- study availability and the work of human resources, including members of school management (SMC), school head, teachers, administrative and support staff).
- observe the existing infrastructure available in the schools (classrooms, libraries, laboratories, playground, sanitation, drinking water facility, mid-day meal facility, inclusive facilities, safety and security, rainwater harvesting).
- observe and document the availability and usage of TLM, including ICT.
- study the available physical and digital documents, including UDISE data.
- study interpersonal relationships among the stakeholders.
- study various assessment processes adopted in different types of schools for holistic development of children.
- prepare and present a comprehensive profile of the schools observed (including classroom processes)
- study the engagement of parents and other community members in school activities.

**Suggestive Mode of Transaction**

- Observation
- Interaction
- Discussion
- Reviewing the available literature on the different schooling system
- Collection of relevant documents and data

Preparation for school observation

- Orientation on the school observation process
- Development of the observation formats/tools

School Observation (minimum three types of schools)

- Student teachers will go for school observation in small groups to observe and collect data by using the developed formats/tools.
- Analysis of the collected data
- Preparing a comprehensive profile of the schools observed

Post-school observation session

- Group-wise presentation of the school profile
- Discussion and Feedback
- Reflection on the understanding of various types of schooling systems.

**Content**

The school observation as a field-based activity will cover observation of school and classroom processes. The student teachers under the mentorship of teacher educators will visit schools, interact with teachers and students and other stakeholders, and relate the observation with the courses studied during the previous semesters, i.e. Foundations of Education, Disciplinary Courses, Pedagogy courses and Ability Enhancement & Value-Added Courses.

- Meaning and Nature of school observation process
- Difference between monitoring and observation
- Theory and practices of school observation components such as:
    1. Schooling system
    2. Rapport with all the stakeholders
    3. Office management procedures of different types of schools
    4. School environment in all perspectives
    5. Process of conducting curricular activities in the schooling process
    6. Existing infrastructure available in the school
    7. Utility of ICT and TLM facilities
    8. Interpersonal relationships among the stakeholders
    9. Various assessment processes adopted in different types of schools.
    10. Engagement of parents and other community members in school activities.

**Activities to be conducted**

**Secondary Stage**

- Visit three types of secondary schools with observation formats developed in the institute and get acquainted with various schooling systems. Establish rapport with all stakeholders.
- Collect information about the demography of students in classes IX to XII and understand the linkage of the secondary stage with the middle stage and higher education through interaction with teachers, students and staff.
- Observe school processes and transactions of the curriculum through experiential learning and prepare a report.
- Interact with teachers and students and report on implementing ten bag-less days and internship opportunities to learn vocational subjects.
- Study the available opportunities for learning interdisciplinary subjects.
- Observe the availability and usage of library resources, laboratories (Atal Tinkering Lab, Physics, Chemistry, Biology, Mathematics, Languages, Social Science, and Computer), sports facilities, and art and music learning facilities.
- Study the provision of other student support services- guidance and counselling, NCC, NSS, health and wellness programme.
- Observe the organization of various activities like classroom teaching-learning processes, laboratory activities, library activities, sports and games, debate/elocution/essay writing and other competitions.
- Interact with School heads and subject teachers to understand how students are evaluated by following different tools and techniques of evaluation, how examinations are conducted, how answers are assessed, and how the result is communicated to parents in at least two different types of schools.

**Assessment**

| S.No. | Activities | Marks |
|---|---|---|
| 1 | Involvement and active participation during the school visit | 15 |
| 2 | Comprehensive School Observation Report based on above mentioned activities | 35 |

| Competence/Artifact | Method of assessment | Assessed By | Credits |
|---|---|---|---|
| Involvement and active participation during the school visit | Observations | Teacher-Educator | 0.5 |
| Comprehensive school profile | Presentation & reflection | Teacher-Educator | 1.5 |

**Outcomes**

Student teachers will be able to:

- describe various schooling systems,
- describe the processes, practices, and overall environment of the school,
- establish rapport with the stakeholders of the school system state the process of conducting different activities in the school,
- describe the available school infrastructure (classrooms, libraries, laboratories, playground, sanitation, drinking water facility, mid-day meal facility, inclusive facilities, safety and security, rainwater harvesting),
- describe the availability and usage of ICT and TLMs
- summarize the available documents in both physical and digital modes, including UDISE data,
- reflect upon relationships among the stakeholders,
- analyze various assessment processes adopted in different types of schools,
- prepare and present a comprehensive profile of the schools observed (including classroom processes).

**Suggested Components for school observation report**

- School information (Context, Vision and Mission, Association with the Board)
- School Infrastructure
- Provision for CWSN/Divyang Children
- Inclusiveness at all levels
- Teacher-Student Ratio

- Teaching-Learning process
    - Academic plan
    - Classroom activities
    - Assessment
- School Development Plan (SDP)
- Academic Calendar
- Administrative processes
    - Maintenance of students' records
    - Maintenance of teachers' records
- Cultural activities
- Sports activities
- Annual Day
- National and Social functions
- School Management
- School Discipline
- Interpersonal Relationships
- Understanding different types (socio-economic status, ability) of students and their needs
- Development of ICT and TLMs
- Engagement of parents and community members in the school activity
- Office Management
- The assessment process includes provision and practices for 360-degree holistic assessment.
- The overall progress of the school (planning, organizing, staffing, directing, motivating and controlling)
- Challenges faced and overcoming them

# SEMESTER VII

**EDFE-701: Perspectives of School Leadership and Management**

| | |
|---|---|
| Credits: 1L+1T+0P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

Amidst the changing policy landscape, the new curriculum framework, the challenge of accommodating and adapting to the changing demands and the increasing expectations that comes with the culture of performativity. The role of the school leader has never been more complex. School leaders are key change agents and as instructional leaders are responsible for improving practice while navigating an increasingly challenging school environment. Understanding the school system, its nuances, the social, cultural, and political contexts and leading schools requires a strong foundation of knowledge and skills to effectively manage improvement and lead successful schools. The course on 'Perspectives on School Leadership and Management' is designed to equip student teachers with the competencies they need to drive school transformation and help diverse stakeholders establish priorities and improve practice.

**Course Learning Outcomes**

After completion of the course, student teachers will be able to:

- describe the diversity of schools in India, its structure, its governance, issues, challenges and school leadership needs,
- critically examine the different leadership theories and practices and its relationship with the governance structures, the autonomy and accountability mechanisms and the larger educational policy context,
- critically think in relation to education leadership and its potential application to different contexts,
- reflect critically on school-based data for reflection and improvement,
- develop a culture of cooperation collaboration and teamwork,
- synthesise effectively to develop coherent and compelling arguments in the area of study,
- develop school vision, mission, goals, and School Development Plans.

**UNIT - I**

Understanding Indian School System

a) School as a normative organization vis-a-vis school as a socio-emotional-cultural space for learning.
b) Studying the diversity of schools in India; their structure, governance, socio-political and cultural context, funding, management, autonomy and accountability mechanisms, support systems.
c) Relationship between school leadership and school diversity issues, challenges, and needs.
d) Engagement with diversity discourses, educational policies, reforms and practices and role in developing inclusive schools.

**UNIT - II**

Understanding School Leadership

a) School Leadership: Concept as defined and concept as practiced.
b) Being a School Leader: exploring the multiple roles and responsibilities, issues and challenges of school leadership in the Indian context.
c) What works in schools: sharing National and International best practices on School leadership?

**UNIT - III**

Schools as Learning Organizations: Role of School Leadership

a) Schools as motivating learning spaces: Developing inspiring school ethos.
b) Schools as learning organization: promoting personal mastery, examining mental models, and developing a shared vision, team learning and a system's thinking perspective.
c) Development of a shared vision and shaping of the school culture.
d) Use of data for school improvement focused on students' learning, addressing equity challenges, and building an equitable school culture that promotes excellence for all.
e) Nurturing school belongingness: engaging students, teachers, staff, parents, SMC, and community in the formulation of a whole school development plan.
f) Designing professional and collaborative learning opportunities for self and others (teachers, parents, and SMC members) and improving teaching and learning.

**Suggestive Mode of Transaction**

Perspectives on school leadership and management are a practitioner-centric course and aims to enable future teachers to be efficient school leaders. The approach to curriculum transaction therefore would include a blend of lectures, tutorials, group-work, case-based approaches, and enquiry-based learning.

- Student teachers would engage in case-based learning on topics like improving student learning, classroom observation and feedback, planning and budgeting for school improvement, leadership in diversified school contexts and such others.
- Exposure of student teachers to virtual case studies featuring leaders from a representative cross-section of Schools in India and analyze their experiences, insights, and best practices.
- Learning activities that help student teachers to understand the entire structure and functioning of school organization through interactive lectures and panel discussion with education officers who hold leadership positions at different levels from schools to cluster, block, and district and state levels and understand their leadership issues, challenges and needs and thus get a perspective of the school ecosystem.
- Learners would reflect on their practice as pre-service interns, knowledge, skills, and understandings—and identify opportunities to apply course learnings to their school context.

**Suggestive Mode of Assessment**

Being a practitioner centric course, the assessment would largely include application-based tasks. This includes exploring the work and life of a school principal and writing a detailed report on the observations and the learning. The following are some exemplars. The institutes may choose either of these or think of other innovative assignment that would enhance the leadership learning experience:

- Preparing school vision, mission, goals, and school development plan.
- Shadowing school principals: a critical observation of the principal's daily work life.
- A critical examination of the diversity of schools; their governance structure, leadership, autonomy and accountability mechanisms, issues and challenges and work life of the school principal

**Suggestive Reading Materials**
Teachers may suggest books/readings as per the need of the learners and learning content.

**EDFE-702: Curriculum Planning & Development (Textbooks, Material Development, etc.) - (Secondary Stage)**

| | |
|---|---|
| Credits: 1L+0T+1P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**
The course on curriculum planning and development will introduce to student teachers to the process of designing and organizing the curriculum i.e., the totality of learning experience provided to learners through a deliberate and organized set of arrangements (the selection of subjects that are to be taught, the pedagogical approaches and practices to be pursued, books and other teaching-learning-material to be used, examinations and other forms of learning assessment, school culture and processes etc.) that contribute to the development of the knowledge, capacities, and values and dispositions that help fulfill the aims of school education derived from the purposes and goals articulated in NEP 2020.

**Course Learning Outcomes**
After completion of this course, student teachers will be able to:
- discuss aims of education,
- identify and formulate of desirable values and dispositions,
- explain capacities and knowledge,
- outline curricular areas,
- demonstrate teaching-learning assessment processes and
- practice the relevance in terms of achieving the aims of school education.

**UNIT - I**

Education and Curriculum

a) Meaning, need, relationship and significance.
b) Types of Curriculums: subject-centered, activity-centered, environmental centered, community-centered
c) Relationship and difference between curriculum, curriculum framework, syllabus and textbooks.

**UNIT - II**

Developing the Curriculum

a) Basic principles of Curriculum Development
b) Concerns for developing the Curriculum - aims to be achieved, structure and nature of discipline, different perspectives on learning and their implications to curriculum development, socio–cultural aspects and aspirations of society, value transitions, social efficiency and needs, environmental concerns, gender concerns, inclusiveness, technological advancement.
c) Impact of Globalization.

**UNIT - III**

Approaches, Planning, and Implementation

a) Approaches to Curriculum Development: Learner and activity centered, Constructivist, Knowledge Construction
b) Curriculum planning as a cyclic process.
c) Curriculum Implementation: Operationalizing curriculum into learning situations, Converting curriculum into syllabus, Curriculum engagement activities, Role of school at Regional, State and National level for implementation.
d) Role of teachers in operationalizing and evaluating the curriculum with special reference to: textbooks and teachers handbooks, source books, workbooks and manuals, other learning material such as kits, AV and software materials, library, laboratory, playground, neighborhood etc.

**Suggestive Practicum**

Arranging discussion on National curriculum frameworks

- Preparing of Report based on observation of facilities and infrastructure to implement the present curriculum.
- Interviewing teachers to understand their role in implementing and assessment of the curriculum.
- Analysis of the NEP 2020 in context of principles of developing the Curriculum.
- Curriculum of 4 Years B.Ed. Integrated Programme
- Learning without Burden, MoE, India.

**Suggestive Mode of Transaction**

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

**Suggestive Mode of Assessment**

The assessment will be based on the tests and assignments.

**Suggestive Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning content.

**AEVA-701 A: Art Education (Performing and Visual) and Creative Expressions**
**Exemplar 2 - Theatre**

| | |
|---|---|
| Credits: 1L+0T+1P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| Internal Assessment | C3=35 |

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| Internal Assessment | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc. (at the end of 15th Week).

**About the Course**

The engagement with various forms of art as self-expression and the need to develop a sensibility to appreciate them has been an important concern in educational theory and practice. This concern is premised on the claim that forms of self-expression contribute immensely to the development of cognitive, affective, and psycho-motor dimensions among children, as well as that through one or another art form that children come to explore ways of expressing themselves. Further, it is also the case that critical appreciation of art enables children to form judgments of a very special kind, namely, an aesthetic judgment. This enables students as they grow into adults to have focused attention on making meaning of what surrounds them and in appreciating cultural productions.

Children are naturally tuned to appreciate art, as it activates their senses. Further, their psycho- motor skills get developed through art. It gives them space to think independently, create and reflect, while working with others. It is a unique space where all the three are involved- hand, head and heart.

Therefore, students who aim to be educational practitioners will need to bring an element of art in educational practices that they engage in. To be able to do this, they need an appreciation of art in general, familiarity with one art form, and basic skills and capabilities to be creative and artful.

To this end in the first semester students will attend one course that aims to help them recognize and appreciate the importance of aesthetic judgment, develop familiarity with an art form and basic skills to be creative in their expressions. Skills develop from practice, therefore hands on training in doing art will be emphasised in this course. This course aims to help students develop a habit of improvising on theatrical performances that include following aesthetic judgement at all stages, which will contribute to other educational practices that they develop in the larger programme. Therefore, this course will explicitly relate this skill to activities that practitioners of education engage in, like teaching, development of teaching-learning material, and also producing content of other subject areas wherever possible.

**Theatre**

Theatre is a collaborative art form, and it is inherently interdisciplinary in its nature. It comprises many facets and skills like acting, directing, writing, designing the sets and costumes, make-up, production, lights, sounds and music. All these elements and skill sets come together and are stitched in the form of a 'play' which is performed live, in front of an audience. In the Indian context, theatre has a deep-rooted history with its classical, folk, and other cultural forms until other contemporary forms of theatre evolved in recent times.

Theatre education for children can play a vital role in their individual, social, and emotional development. It teaches them the values of trust and interdependence, makes them confident to express themselves and helps them learn to work in a collaborative environment. It develops their ability to contextualise critique and discuss certain questions and thoughts they encounter in everyday life. It further helps them imagine, explore, and create their own narratives.

In this course, we will briefly talk about the aesthetics of theatre and how theatre exists in different forms. The students will learn some basic theatre tools that will help them create and perform a narrative they collaboratively arrive at.

In simple terms one can say theatre has two major aspects i.e., creating the script and then performing it. Body is the primary instrument in any theatrical performance accompanied by text, material, visual and sound. This course will introduce students to these aspects of any theatre performance, in the form of direct experience by doing this themselves.

**Course Learning Outcomes**

After completion of this course, students will be able to:

- articulate the importance of aesthetics and art in elementary education,
- demonstrate their familiarity with and appreciation of theatre,
- learn basic theatre tools of improvisation, ideation, and creation of a script,
- create a short performance with educational possibilities.

**UNIT - I**

Introduction to Theatre and Beginning with the body, core essentials of theatre like the performance, the makers, the audience, and the context. Relating it to the world around us in everyday lives. Examples of theatre used in social movements and its contribution to education with reference to social issues. Practices and approaches of theatre groups like Budhan Theatre and Manalmagudi theatre. Approaches leading to learners on the role of theatre in pedagogy and class room practices.

Principles and awareness on body and voice in a given space and time, with respect to other bodies. Games, exercises to familiarise learners with certain basics of movement, voice, acting and thereby create improvisations and images in a given context. Individuals and group activities/tasks.

**UNIT - II**

Arriving at a script

Engaging learner in script making processes. Adapt or devise a script with actors. Borrowing from everyday experiences of memory, sound and visuals, without a written text/spoken word. Plays, stories, poems, newspapers articles to share with learners to read, reflect, analyse and re-create (like - “Why, why Girl” by Mahashweta Devi, “Ratna Pakshi” by K Ramaiah, “Beyond the land of Hattamala and Scandal in Fairyland” by Baadal Sircar, and songs of Kabir etc) having direct relation with topics from social studies, moral and political education. Using skills for improvisation to explore, ideate, create, and finally arriving at a script. Stories, narratives, and characters choose to perform script and the discussion of aesthetics. Engaging students in groups to choose or create a text, concept, or an idea to perform, encouraging students to use their perspectives on the education system in converting the text into a script.

**UNIT - III**

Performing the script

Engaging students in finalizing script. Visualizing the final text on stage and rehearsing in groups. Designing other aesthetic elements like sets, props, costumes, lights, music and sounds used for performance. Feedback on the work progresses. Significance of rehearsals, post-performance and assessments. Engaging students in discussion and reflecting on the views, questions and comments of audience.

**Pedagogy**

The pedagogy is basically hands-on training. More emphasis is given to experiential learning. They do things and through doing, they learn about art and its connection to education. The process takes you through different forms of art- fine arts, playing with colours, costume designing, facial make -up, script writing, music, and performance.

**Suggestive Mode of Assessment as per following Table:**

| Mode of Assessment | | |
|---|---|---|
| Week | Topics | Session flow |
| 1 | UNIT - I: Aesthetics and art, art in everyday life. Importance of art. Appreciation of art | Based on their experience |
| 2 | Art for art's sake. Art with social responsibility. Art for social change | Discussion |
| 3 | UNIT 2: Aesthetics of Theatre | Discussion |

| | | |
|---|---|---|
| 4 | Body work - Individual and group | Hands on |
| 5 | Body work – Improvisation | Hands on |
| 6 | UNIT - III: Adaptation of texts. Aesthetic choices. | Hands on, discussion |
| 7 | Story making and devising | Hands on |
| 8 | Arriving at a text | Hands on |
| 9 | UNIT - IV: Visualising the final piece.<br>Thinking about design and aesthetic elements. | Hands on, discussion |
| 10 | Rehearsals and feedback | Hands on |
| 11 | Rehearsals and feedback | Hands on |
| 12 | Final rehearsals and assessment | |
| 13 | Final rehearsals and assessment | |
| 14 | Performance and audience discussion | |

**Suggestive Reading Materials**
Teachers may suggest books/readings as per the need of the learners and learning content.

**AEVA-701 B: Art Education (Performing and Visual) and Creative Expressions**
**Exemplar 2 – Collage**

| | |
|---|---|
| Credits: 1L+0T+1P | Marks 50 |
| Contact hours per week: 3 | C1+C2=5+10 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 5 | 1hr | 20 |
| Internal Test (C2) | 10 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: Performance activities as per Suggestive Mode of Assessment (before End-Semester examination).

**About the Course**
Engagement with various forms of art as self-expression and the need to develop sensibility to appreciate them has been an important concern in educational theory and practice. This concern is premised on the claim that forms of self-expression contribute immensely to the development of cognitive, affective and psycho-motor dimensions among children, as well as that through one or another art form, children come to explore ways of expressing themselves. Further, it is also the case that critical appreciation of art enables children to form judgments of a very special kind, namely, aesthetic judgment. This enables students as they grow into adults to have focused attention on making sense of and appreciating cultural productions.

Children enjoy artwork a lot. They explore and find meaning in artwork. Their psycho-motor skills get developed through art. The huge element of socialization is acquired through different forms of art. They get to know each other and understand each other and make friends through art. They develop their peer group through getting involved in art forms. Learning to work with others is also achieved through art. It gives them space to think independently, create and reflect. It is one space where all the three are involved- hand, head, and heart.
Therefore, educational practitioners that the students aim to be, will need to bring an element of art in practices that they engage in. To be able to do this, they need an appreciation of art in general, familiarity with one art form, and basic skills and capabilities to be creative and artful. Additionally, they should be familiar with some critical debates in art education, even if their work is in other subject areas.
To this end, students will do one course that aims to help them recognize and appreciate the importance of aesthetic judgment, develop familiarity with an art form and basic skills to be creative and artful in their expressions. Skills develop from practice, therefore hands-on training in doing art will be emphasized in this course. This course aims to help students develop a habit of performing skillful activities that are essentially aesthetic and artful which is expected to contribute to other educational practices that they develop in other courses in the programme.
Therefore, this course will explicitly relate this skill to activities that practitioners of education engage in, like teaching, development of teaching-learning material, and content of other subject areas wherever possible.

**Collage as visual art medium**
A major aspect of college, and one that is sometimes overlooked, is the incredibly diverse array of materials and objects that can be used. Collecting interesting materials is an ongoing activity for artists and for those who teach college. But it is just as important for young people to hunt for and make decisions about materials they would like to incorporate into their work. All materials, and the alterations that artists make to them, are suggestive of ideas and concepts based on their surfaces, forms, textures, degree of transparency and opacity, color, and other visual characteristics. Materials also connect us, through association and reference, to social and cultural worlds and places. What ideas might a scrap of newspaper, as a collage material, express? How might these meanings differ from those of, say, feathers? Or twigs? Or a thin piece of plastic cut out from a plastic bag?
Working with and creating artwork in Collage involves various aspects: selecting materials, manipulating materials, investigating materiality, closely observing materials, discovering possibilities, composing, designing the artwork, planning, finding solutions, applying solutions, thinking flexibility, decision-making, research, using imagination, expressing, taking creative risks, develop perseverance, and much more. Students will also be introduced to various aspects of art in education: The value of art and artmaking by itself, art's use as an instrument in education, social and moral dimensions of art, and the controversial perceptions around good art and bad art.
This course aims for students to understand the importance of aesthetics and art in education, the role art can play in education, and mainly to appreciate, understand and gain skills with the medium of collage and its techniques.

**Course Learning Outcomes**
After completion of this course, students will be able to:

- articulate the importance and the role of aesthetics and art in education.
- understand the medium of collage and its versatility.
- design, plan, and create an expressive self-portrait collage by applying a variety of collage techniques.
- design and set up an interactive visual art exhibition to display their artworks.
- understand and appreciate art-based learning experiences.
- develop the ability to reflect and challenge their assumptions and beliefs around art and develop new understandings.

**UNIT - I**

Understand the importance of Aesthetics and Art in Education
Introducetion to Aesthetics and Arts by engaging in experiences, discussions and dialogues. 'Visual thinking strategy' (VTS) activity in groups to view collectively and engage in a series of artworks closely, share their observations, critically analyze their observations, listen to multiple perspectives from peers, suspend judgements, and draw their own understanding of the artwork. Recognizing aesthetic and un-aesthetic experiences through compare and contrast.

Exploring paper collage and its techniques

The medium of collage, collage artworks, artist process and artist interview videos. Compare and contrast various ways collage. Reflection on their own past art educational experiences and observations and engage in dialogue. Analyze effective and ineffective ways of medium of collage in educational and other settings.
Inquiry-based participatory demonstrations, investigatory and discovery through variety of ways to manipulate paper and create individual and unique two-dimensional compositions in the medium of paper Collage. Techniques, artistic terminologies of the collage medium. Role of art medium exploration and how it can foster various learning skills. Visual textures, physical textures and their creation patterns. Techniques to create unique textures and patterns, analyzing their findings and feedback in groups. Various materials like - kinds of paper, paper- based materials, natural materials, fabric to create collage compositions. Reflection on exploration experience and understand how art making processes can develop skills and abilities in a learner.

**UNIT - II**

Ideating for an Expressive Self-Portrait
Exploration and discovery of Collage as a medium. Ways to make paper stands and create interesting paper sculpture compositions using 3D techniques. Drawing 2D explorations and add more interest to their 3D explorations. Sharing findings with peers and widen their understanding about the possibilities. Reflection on the material exploration in a facilitated dialogue around art making and education. Engaging in a close observation, sketching and drawing activity. Creating a well observed self-portrait drawing experiences, learnings, discoveries and challanges.

**UNIT - III**

Creation of an Expressive Self-Portrait Collage
Process involving sketching, ideating, planning, applying their discoveries of using paper as a collage material. Problem-solving, critical thinking, pushing imagination, finding multiple solutions, making independent decisions, receiving and giving feedback, using resources effectively, drawing experiences, applying learnings into creating unique and expressive self-portrait piece.
Designing and setting up an Exhibition
Designing and planning for the exhibition, various aspects of a visual art exhibition: ways to display artworks, designing the layout of the exhibition space, design invitations and engaging with the artworks.

**Pedagogy**

- Students will engage in hands-on art making activities.
- Students will engage in discussions and dialogues with peers.
- Students will engage in giving and receiving peer feedback.
- Students will continually reflect on their learning through journaling.
- Students will work independently and collaboratively throughout the course.
- Students will receive reference materials and resources to broaden and deepen their understanding.

**Suggestive Mode of Assessment as per following Table:**

| Mode of Assessment | | |
|---|---|---|
| Week | Topics | Session flow |
| 1 | UNIT - I: Aesthetics and art, art in everyday life. Importance of art. Appreciation of art | Disucssion and Experience Based |
| 2 | Building up Visual Thinking Strategy | |
| 3 | Art for art's sake. Art with social responsibilities, Art for social change | |
| 3 | UNIT - II: Literature review of suggested sources | Discussion/Assignment |
| 4 | Construction of Ideas and its expression through different mediums | 2D Collage |
| 5 | Construction of Ideas and its expression through different mediums | 3D Installation |
| 6 | UNIT - III: Idea of Self-Expression, Self Portrait, Self Exploration | Write ups, Assignments |
| 7 | Idea construction of Exhibition and its preparation | Group Discussion in classroom |
| 8 | Identifying subject area of Final Display/Exhibition | Group Discussion in classroom |

| | | |
|---|---|---|
| 9 | Final Display and critical review from audience | Hands on preparation and Display |

**Suggestive Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning content.

Resource Videos

1. Works of Deborah Roberts, William Kentridge, Wangechi Mutu, etc
2. Marc, Cut paper collage artist - https://www.youtube.com/watch?v=WgRZlWl-Oh0
3. G. Subramanian: Collage art - https://www.youtube.com/watch?v=ioRRi9R46a0
4. Amber Fletschock, Collage artist - https://www.youtube.com/watch?v=aa7p1vYqUc4
5. Arturo Herrera, artist - https://www.youtube.com/watch?v=Oagx3_NZ5HU
6. Resources: Handouts out on Collage techniques and artist examples
7. Resources: JR's Face to face project (videos and readings)
8. https://www.youtube.com/watch?v=4u_G0G6Jog4

**AEVA-702: Sports, Nutrition and Fitness**

| | |
|---|---|
| Credits: 1L+0T+1P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

This course aims at enabling student teachers to recognize the importance of good health, fitness, and the right nutrition to live a healthy life. It also provides students with the experience of organizing and participating in sports and games.

**Course Learning Outcomes**

After completion of the course, student teachers will be able to:

- explain the importance of sports, and the need and impact of sport for maintaining,
- discuss physical fitness, and the methods of teaching and organization of different types of sports,
- explain the importance of physical fitness, describe different components of physical fitness, and identify activities that help maintain physical fitness,

- Recognize the importance of basic health and nutrition and healthy lifestyles and identify food items that help maintain basic health and nutrition among children of different age groups.

**UNIT - I**

Sports

a) Meaning of sports, importance of sports, types of sports.
b) Different stages of sports (primary and secondary).
c) Psychology of sports, methods of teaching different sports (indoor, outdoor, team and individual), different sports activities (individual and team games).
d) Sports for children with disabilities and inclusion.

**UNIT - II**

Physical Fitness

a) Meaning and importance of Physical fitness, components of physical fitness, Muscular Strength, Endurance, Flexibility, Body Composition, Cardiovascular Endurance, importance of healthy lifestyle.
b) Coordination of Health and Fitness.

**UNIT - III**

Nutrition

a) Meaning of nutrition, types of nutrition, importance of nutrition, need of nutrition, methods for teaching nutrition,
b) Nutrition for different age group, nutritious food for sports personalities and common individuals, nutrition and health, nutrition and fitness, nutritious food in schools (midday meals), hostels.

**Suggestive Practicum**

Reflective Reading of different Sports Personalities, Collections of different types of games (Indoor, Outdoor, Individual, Team); Organizing different games (Play) for different age-groups, Organizing Group Games for cooperation, Organizing fitness programmes, Exercises at various levels, Collection of different nutritious items food, (Charts, Things, Objects, Models). Programmes organized to promote the use of nutritious food.

**Suggestive Mode of Transaction**

The mode of transaction should be designed to ensure that should provide a balance between theoretical knowledge and practical skills. The approaches to curriculum transaction may include the following:

- Active learning encourages student teachers to participate in discussions, brainstorming sessions, and problem-solving activities that help them develop critical thinking and problem-solving skills.
- Collaborative learning involves group projects and tasks that encourage student teachers to work collaboratively and learn from each other.

**Suggestive Mode of Assessment**

Assessment of theoretical aspects and Practicum

**Suggestive Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning content.

**EDSE-701: School Based Research Project**

| | |
|---|---|
| Credits: 1L+1T+0P | Marks 50 |
| Contact hours per week: 3 | |
| Internal Evaluation (research project at the Institute) | 50 |

| Paper | Max.Marks | Min. Pass Marks |
|---|---|---|
| Internal Evaluation | 50 | 20 |
| **Total Marks** | 50 | |

**About the Course**

Action research enables teachers to reflect on their wisdom to bring the desired changeover and explore the system when necessary. They may experiment with practices in a controlled environment to improve the transactional processes. Learning about classroom research in action research and case studies practices promotes opportunities to improve the student-teacher learning environment in teacher education institutions. Their involvement in the learning processes during their stay in teacher education institutions becomes more fruitful. It could be individual or collaborative research among the student teachers. Action research and case studies are school-based research, which is acted upon as collective, self-reflective inquiry undertaken in social situations to improve the rationality and justice of their own contextual and educational practices. These two processes explore the answers to the problem and contribute towards theory development. These two methodologies foster critical thinking, problem-solving, collaboration and ethical decision-making skills. The student teachers are placed in schools for internships. School Internship provides the student teachers with a platform to apply theoretical knowledge understanding, techniques, methods, and approaches in an actual classroom situation. It enables them to gain intensive experience in teaching, planning, preparing support materials, and performing other school activities that a regular teacher is expected to do. The student teachers will systematically undertake school-based research to find solutions to contextual problems/challenges. During the school internship, the student teachers will identify school practices and challenges through involvement in different activities, design relevant interventions analyze data and prepare reports.

**Course Learning Objectives**

The student teachers will:

- Identify contextual problems and formulate appropriate research design,
- Prepare the plan of action for undertaking school-based research,
- Develop and use tools and techniques for the collection of relevant data,
- Collect and analyze the data to identify the causes,
- Develop and implement need-based interventions for addressing the problems,
- Study the effectiveness of the intervention(s),
- Reflect and share school-based research experiences through reports and presentations.

**Suggestive Mode of Transaction**

The following strategies will be used during the school-based research project:

- Discussions with teacher educator, school head, mentors, and peers for identification of problem and development of intervention(s).
- Finalize the school-based research project proposal outline through discussion with mentor teachers/teacher educators.
- Document analysis, interaction with all stakeholders, and field visits.
- Sharing and presentation of the outcomes of school-based research.

**Content:**

The student teachers during previous semesters have studied different courses in Foundations of Education, Disciplinary Courses, Stage-specific pedagogy courses, Ability Enhancement and Value-Added Courses. The required knowledge of action research and case study includes- the concept and importance of action research/case study, the steps of conducting action research/case study (objectives, methods, research design, design tools, data collection, and data analysis) and report writing.

The research problem will be taken from the day-to-day teaching-learning process of the school. Some of the significant areas may cover:

- Learning progress and outcomes in different subjects
- School-based assessment
- Learners' diversity and inclusion
- Participation in arts, games, sports

**Assessment**

| S.No. | Activities | Marks |
|---|---|---|
| 1 | Proposal of Action Research/Case Study | 15 |

| | | |
|---|---|---|
| 2 | Finalization and Presentation of Research Report | 35 |
| Total | | 50 |

The assessment of the school-based research project will be continuous. The teacher educators, as well as mentors, will be involved in the assessment of the activities. The following rating scale may be used to assess the student teachers

| Competence/Artifact | Method of assessment | Assessed By | Credits |
|---|---|---|---|
| Observation during the execution of action research | Observations | Teacher Educator | 0.5 |
| Research Report | Presentation of Report | Teacher-Educators (panel of three experts) | 1.5 |

**Course Learning Outcomes**

The student teachers will:

- present contextual problems, an appropriate research design and the plan of action for undertaking school-based research,
- demonstrate the tools and techniques used for the collection of relevant data,
- summarize the analyzed data used to identify the causes,
- demonstrate the interventions used for addressing the problems,
- present the effectiveness of the intervention(s),
- share the school-based research experiences through reports and presentation.

**EDSE-702: Internship in Teaching**

| Paper Code | Name of the Paper | Credits | Maximum Marks |
|---|---|---|---|
| EDSE-702 | Internship in Teaching | 10 | 250 |

**About the Course**

Teacher preparation is a reflective and experiential process, and internship is vital to connecting student teachers with school, teachers, students and other stakeholders in various ways. It provides a platform and actual field experience for the student teachers to apply theoretical knowledge and teaching methods. During the internship, student teachers are placed in schools in groups as an integral part of all school activities. This provides them with the opportunity to observe classes taken by school teachers, take independent classes, develop a relationship with students, contribute to everyday school activities (e.g., conducting the assembly, assisting in the mid-day meal scheme, organizing school events) and get exposure to all school administrative practices (e.g., maintaining administration records, creating an annual calendar). This enables them to get intensive experience in all aspects of teaching- preparation, planning, developing/ collecting/localizing Teaching Learning Materials, classroom transactions, assessment, reflection, and review of their experience. The student teachers are exposed to situations where they can observe different roles played by the teacher in the field, which they will also have to undergo. After completing the internship, student teachers will be ready to take up a teacher's responsibility independently.

**Suggestive Structure**

ITEP 7th semester has an internship programme where student teachers are expected to go to the participating schools and visit the Institute for completion of other courses. ITEP institute can choose suitable option based on their context.

- Initial first week at the Institute.
- Next 14 weeks in practising schools.

**Course Learning Objectives:**

On completion of the school internship, student teachers will be able to:

- explain the overall functioning of the school.
- describe and appreciate the different roles played by a teacher in the school.

- experience the importance of teacher-student relationships for effective teaching.
- develop age-appropriate pedagogic skills.
- use different pedagogies learnt in real-life classrooms.
- create appropriate teaching-learning materials.
- develop necessary planning and execution skills to conduct school activities (assembly, celebrations, cultural programmes).
- express the school, teacher, parents, and community relationships.
- create rapport with the stakeholders and understand their roles in the school system.
- create student portfolios and comprehensive 360-degree (holistic) progress reports.
- discuss the importance of maintaining different types of records in the school system.
- develop research aptitude and ability to conduct action research for the situations/problems faced during their school internship experience.

**Suggestive Mode of Transaction**

- Observation
- Interaction
- Discussion
- Teaching in the classroom
- Analysis and reporting
- Collection of relevant documents and data

**Content**

- Pedagogies' different methods and strategies
- Scheme of lessons
- Peer lesson observation
- Management of substitute classes
- Various TLMs (including ICT tools) and their uses in teaching-learning.
- Achievement test
- Diagnostic tests
- Analysis of the result of the achievement test
- Assembly activities
- Action research and case studies.

**Activities**:
Student teachers are required to undertake the following stage specific activities:

**Secondary Stage**

- Meet the subject-based mentors, collect timetables of classes IX to XII and develop a scheme of lessons from the syllabus to be covered during the internship.
- Get acquainted with the school within 2-3 days. Observe classroom teaching of school teachers.
- Plan and transact minimum 80 lessons (40+40), including 4 stray lessons (2+2). Stray lessons are class appropriate lessons on any topic(s) to be transacted by student teachers as per their convenience to build up confidence gradually. The last 5 lessons in each pedagogy course may be transacted using lesson notes.
    - Lesson plans should include the components to develop critical and reflective thinking, problem-solving, differential learning, synthesis, and application of knowledge in real-life situations.
    - Lesson plans must promote education for sustainability, including equity, environment, global citizenship, pride and rootedness in Indian knowledge systems and character building.
- Participate in post-lesson discussions with peers, mentor(s) and teacher educators.
- Observe peer lessons and discuss with the group.
- Conduct laboratory activities (Atal Tinkering Lab, Physics, Chemistry, Biology, Mathematics, Languages, Social Science, and Computer), sports, and arts and crafts activities.

- Participate in student support services- guidance and counselling, NCC, NSS, health and wellness programme.
- Create teaching-learning materials, including ICT tools for opted pedagogic courses.
- Plan assessment, prepare material and formative and summative assessment tools, and analyze the results.
- Prepare and conduct diagnostic tests to identify learning difficulties, analyze data and prepare learning enhancement plan.
- Experience classes as a substitute teacher.
- Participate in library functioning and literary activities.
- Participate in teacher development and training activities.
- Organize school assemblies and other events (cultural, sports, yoga, and other development activities).
- Attend Parents-Teachers Association (PTA) meetings if held during the internship.
- Attend School Management Committee (SMC) meeting if held during the internship.
- Study the process of parent and community engagement for the school development programme.
- Conduct action research /case study.
- Prepare a sample student portfolio,
- Write a reflective diary daily and prepare a report of each activity.

**Assessment**

| S.No. | Activities | Marks |
|---|---|---|
| **1** | • 40 lessons transacted for each pedagogical subject including Unit plans and lesson plans<br>• Minimum 2 Innovative lesson plans in each pedagogy subject (Eg: Storytelling, Drama based, Arts and crafts, Use of Technology) | **60+60=120**<br>**15+15=30**<br>**(150)** |
| **2** | • Preparation of report on assessment plan in each lesson transacted i.e., within lesson transaction and lesson end activities.<br>• Preparation of a Blue Print (For one/two Pedagogical course/s) and preparation of Assessment tools Conduct of Unit Test & analysis of results (for both Pedagogical course/s). Development of plan for learning enhancement of students related to subjects (for both Pedagogical course/s) | **20**<br>**20**<br>**(40)** |
| **3** | Participation/Organization of assembly and other school-level activities, PTM & SMC Meetings | **10** |
| **4** | Preparation of Logbook /Teachers diary Min 5 lessons for each pedagogical method | **10** |
| **5** | Overall feedback on student-teacher performance by School Head | **10** |
| **6** | Test lesson (one in each pedagogical method) | **15+15=30** |
| Total | | **250** |

The activities conducted / skills acquired during the internship by the student teachers will be assessed as per the following scheme.

| Competence/Artifact | Method of assessment | Assessed By | Credits |
|---|---|---|---|
| Observation of classroom practices | • Observation of a Minimum of 6 lessons of School Teachers (3+3)<br>• Observation of a Minimum of 10 lessons of Peers (5+5 | Teacher-Educator | Non-evaluative |
| Unit planning, Lesson Planning & Transaction | 40 lessons transaction for each pedagogical subject<br>❖ Unit plans and lesson plans<br>❖ Minimum 2 Innovative lesson plans in each pedagogy subject (Eg: Storytelling, Drama based, Arts and crafts, Use of Technology) | Teacher-Educator, School Mentor | 6.0 |
| Assessment Planning and execution | Preparation of report on assessment plan in each lesson transacted i.e., within lesson transaction and lesson end activities. | Teacher-Educator, School- | 1.5 |

| | | | |
|---|---|---|---|
| | Preparation of a Blue Print (For one/two Pedagogical course/s) and preparation of Assessment tools Conduct of Unit Test & analysis of results (for both Pedagogical course/s) Development of plan for learning enhancement of students related to subjects (for both Pedagogical course/s) | Mentor | |
| Participation/Organization of assembly and other school-level activities, PTM & SMC Meetings | Observation & Interaction | School Mentor | 0.5 |
| Preparation of Logbook /Teachers diary Min 5 lessons for each pedagogical method | Review | Teacher-Educator, School Mentor | 0.5 |
| Overall feedback on student-teacher performance by School Head | Observation and Interaction | School Head | 0.5 |
| Test lesson (one in each pedagogical method) | Presentation | Teacher-Educator | 1.0 |

**Stakeholders Responsibilities**

Role of Head of ITEP Institution

- Identification of the adequate number of internship schools
- Signing the MoU with the schools
- Sharing of mutual expectations of ITEP institutions and the participating schools
- Identification of the internship programme coordinator
- Monitor the progress of the entire School Experience Programme

Role of Teacher-Educators of the ITEP Institution

- Guide the student teachers in preparing lessons and activities, assessment, observation of lessons on peer teaching, action research, and case studies conducting school activities preparation and report writing on Teaching Learning Materials.
- Conduct pre- and post-lesson discussions regularly.
- Assess the transaction of lessons for the complete duration of the lesson in the rating proforma developed by the teacher education institute and give feedback/remarks to the student teachers for lesson improvement.
- Submission of monitoring and supervision reports to the institute in time.
- Discuss with the student teachers frequently and organize a phase-end meeting of the student teachers and mentors to assess the progress and performance of the student teachers.

Role of School Head

- To introduce the student teachers to the students and staff of the school in the assembly on the first day.
- To facilitate student teachers to take classes as per stage requirements- Foundational,Preparatory, Middle, and Secondary
- Ensure the alignment of the timetable, scheme of lessons and plan of activities/ assignments of the student teachers to be carried out during the programme in the school.
- Countersign on the attendance register maintained by the group leader/ mentor of the school.
- Ensure that all facilities and provisions are available to the student teachers to teach their lessons and carry out their assignments smoothly.
- grant of leave applications of the student teachers in exceptional circumstances.
- Involve student teachers in different activities of the school.

- Facilitate phase-end meetings of the student teachers and the mentors to assess the progress and removal of difficulties.
- Countersign/ certify the report/ documents of the activities/ assignments conducted by the student teachers towards the end of the internship programme.
- Provide input about student-teacher performance.
- Provide suggestions for improvement of the programme to the ITEP institution.

Role of Mentors

- Guide student teachers to prepare detailed lesson plans, brief lesson notes and plans of activities/ assignments to be conducted by them in school.
- Review the lesson plan before a student-teacher transacts the lesson in the class.
- Observe the classes of student teachers.
- Assess each lesson on the prescribed proforma and write remarks in the lesson plan book provided by the student teachers.
- Give feedback continuously to the student teachers for their improvement in their teaching and other curricular activities.
- Conduct post-lesson discussions regularly.
- Countersign in the peer-teaching observation schedules after their observations in the classroom.
- Organize frequent meetings with the student teachers and supervisors to discuss the progress, difficulties faced, and experience gained by student teachers.

Role of Student-Teacher

- Report to the school head of the participating school at least one day before the start of the internship placement.
- Seek information about the classes, timetable, and topics to teach in stage-specific pedagogic courses from the mentors on the first day of the internship programme.
- Mark your attendance as per the school practice.
- Plan all the assignments/ activities with the help of the mentor/ supervisors.
- Seek cooperation from mentors and supervisors in case of difficulty.
- Prepare the lesson plan and get approval from the mentor/ supervisor before transacting every lesson.
- Take classes according to the timetable of the participating school.
- Take substitute classes and participate in other school duties assigned by the school.
- Follow the conduct and dress code of the participating school.
- Get prior leave approval from the head of the participating school in case of emergency.
- Maintain a diary and regularly list all the innovations, challenges faced and reflections for improvement.
- Check with your mentor before attempting learning activities that depart from routine classroom procedures.
- Carry out the activities you plan for school students according to your approved plans.
- Maintain cordial relationships with the students and staff of the school.
- Refrain from making negative comments about the school or the school's personnel, especially when talking with fellow student teachers.
- Submit student teaching profiles, one each, to the supervisor and mentor who supervises your teaching.
- Before the completion of the internship programme, make sure to return all textbooks and materials to the school.

# SEMESTER VIII

**EDFE-801: Philosophical & Sociological Perspectives of Education-II**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

Sociological Perspectives of Education seek to encourage students to explore the relationship between social structures and educational provision. The course focuses on the study of the social behavior of individuals, groups, and societies. It provides opportunities for student teachers to examine relationships among individuals, as well as relationships between people and their societies.

**Course Learning Outcomes**

After completion of this course, student teachers will be able to:

- recognize the social context of education,
- outline the meaning, nature, and scope of educational sociology,
- establish the link between education and socialization,
- analyze the main agents of socialization, such as family, school, community and peer groups,
- analyze the impact of culture on education through a study of dimensions of culture and their importance to education practices,
- recognize the different aspects of social stratification,
- identify the close relationship between education and modernization, the role of education in Modernization, and factors and constraints to social change.

**UNIT - I**

Education and Society

a) Conceptual clarity, relationship, significance and aims of studying relationship between these two.
b) Educational sociology and social perspective of education: meaning and functions.
c) Education as a Social System.

d) Conceptual clarity of the following terms: society, social behavior, status, institution, ideology, system, sub-system, socialization, social system, social values and norms, conflict, modernization.
e) Understanding the relation between individual and group behavior with special reference to purpose of education.

**UNIT - II**

Education and Social Change

a) Meaning, relation, and dimensions of Social Change.
b) Factors affecting Education and Social Change: technology, social and educational movements, curricular innovations, value conflict, legal provisions.
c) Constitution of India and Education.
d) Education and Modernity.
e) Role of education with reference to social change.

**UNIT - III**

Education, Culture and Socialization

a) Relationship between Education and Culture.
b) Education as a process of Socialization.
c) Impact of following on Culture and Educational Process: Social Welfare, Social Reform Movements, Legal interventions on Child Marriage and child labor Act, Educational Policies and Acts, Adult Literacy, New Technology of communication, Equality.
d) Constitutional Provisions and Education with special reference to Social Equality and Equity.

**UNIT - IV**

Education and Values

a) Conceptual Clarity, Relationship and Significance.
b) Types of Values.
c) Constitutional Values and its impact on our Education.
d) Human Rights and Values.
e) Environment and Education.
f) Pedagogical issues.

**Suggestive Practicum**

- Critical/Reflective study of contemporary aims of education and their social determinants.
- Observation and critical study on how textbooks determine every activity of teacher and learner in the school.
- A critique of textbook culture in school.
- Observing the process of knowledge construction by children in structured and unstructured environments to appreciate their learning processes and nature.
- A critical analysis of Constitution of India in the context of process of Education in India/ Educational Policies / Educational Commissions)
- Critically observing nearby society/ locality in groups of 4-5 students and sharing observations related to cultural/ social influences on educational practice.
- Analyzing social purpose of NEP, 2020.

**Suggestive Mode of Transaction**

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

**Suggestive Mode of Assessment**

The assessment will be based on the tests and assignments.

**Suggestive Reading Materials**
Teachers may suggest books/readings as per the need of the learners and learning content.

**EDFE-802: Education Policy Analysis**

| | |
|---|---|
| Credits: 1L+1T+0P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**
This course on Education Policy Analysis aims at orienting student teachers to the theoretical frameworks and methodology that will help assess and evaluate the effectiveness of policies at the national, state and programme levels.

**Course Learning Outcomes**
After completion of this course, student teachers will be able to:
- discuss knowledge and capacity to engage in education policy analysis and evaluate their effectiveness,
- explain processes involved in policy analysis including undertaking situation analysis and research.
- To identify possible policy options,
- Describing these possible options,
- Comparing the potential policy options,
- Ranking the possible policy options and
- Choosing the most effective option that could address issues and problems confronting school education.

**UNIT - I**

Planning an Educational Policy
a) Meaning and significance of `Policy on Education'.
b) Purpose and Dimensions of an Educational Policy at local and Global level.
c) Philosophical and Sociological Perspective of planning an Educational Policy.
d) Historical development of Educational Policies in India.

e) Basic steps involved in planning.Constitutional provision for Policy on Education.
f) Fundamental principles for analyzing an Educational Policy.

**UNIT - II**

Educational Policies in India

a) Critical analysis of Policies on Education since Independence: 1968, 1986 (Modified in 1992), 2020 in the context of: need and significance, goals and frameworks of educational policies, content of policies, issues raised in policies, constitutional provisions, special stress, modification of policies, implementation strategies.
b) Issue of modifying an Educational Policy.

**UNIT - III**

Implementation of an Educational Policy

a) Meaning, need and significance.
b) Mechanism of Policy Implementation.
c) Strategies to Implement an Educational Policy.
d) Programme of action and implementation: conceptual clarification and significance.
e) Role of different Organization / Groups: Legislature/ Judiciary/ Political Will and Parties/ Voluntary Organizations/ Non-governmental organizations (NGOs)/ Pressure Groups/ Public.
f) Challenges for Implementation.

**Suggestive Practicum**

- Reviewing and presenting report on NEP 2020 in reference to Policy Implementation.
- To present a critical review of the Programme of Action.
- Preparing a list of challenges to implement the present National Education Policy 2020.
- Preparing a list of Measures taken to implement National Education Policy 2020.

**Suggestive Mode of Transaction**

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children and schools.

**Suggestive Mode of Assessment**

The assessment will be based on the tests and assignments.

**Suggestive Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning content.

**ELECTIVES (One Elective from the offered courses)**

**EDFE-803 A: Aldolescence Education**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.

- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

The course is designed to develop a comprehensive understanding and knowledge about Adolescence and Adolescence education with special references of Adolescence Education programmes in India at School level. There is an attempt to develop understanding about intellectual, emotional, physiological, socio-cultural, and interpersonal issues related to the processes of growing up and to inculcate healthy attitude towards sex and sexuality, respect for the opposite gender and understanding of responsible social behaviour. The course highlights core life skills and their significance in adolescence life period and try to know about the various Adolescence Education programmes undergoing for Adolescence in India.

**Course Learning Outcomes**

After the completion of this course students will be able to:

- develop sensitivity, understanding and knowledge about Adolescence and Adolescence Education,
- know the historical development of Adolescent Educational Programme in India,
- know the role of local as well as international agencies towards Adolescent Educational Programme,
- develop a positive attitude towards the importance of Adolescence Education Programmes at the school level,
- develop knowledge and sensitivity on matters related to reproductive health, sex and sexuality and communicate effectively on these issues,
- develop understanding about intellectual, emotional, physiological, socio-cultural, and interpersonal issues related to the processes of growing-up,
- inculcate a healthy attitude towards sex and sexuality, respect for the opposite gender and an understanding of responsible sexual behavior,
- develop an understanding about the desired life skills,
- acquire pedagogical related skills for Adolescence Education Programmes.

**UNIT - I**

Adolescence and Adolescence Education

a) Understanding Adolescence: intellectual, emotional, social, and physiological aspects of Adolescence, issues and challenges during Adolescence, myths and realities.
b) Adolescence Education: concept, nature, and significance of Adolescence Education in Indian context, aims and objectives of Adolescence Education.
c) Role of school, family, media, and community as social agencies in Adolescence Education.

d) Challenges of Adolescence Education.

**UNIT - II**

Life Skills and Adolescence Education

a) Concept, nature, and significance of Life Skills for Adolescence Education.
b) Relationship between Life Skills and Adolescence Education.
c) Core Life Skills and their significance.
d) Understanding sexual and reproductive health.
e) STIs and HIV/AIDS: causes, prevention, cure, and skills of coping.

**UNIT - III**

Adolescence Education Programme in India (AEP)

a) Historical Development of Adolescence Education Programme in India.
b) Goals and Significance of Adolescence Education Programme in India.
c) Role of Teachers in Adolescence Education in India (AEP).
d) Challenges to Educational Programmes in India.
e) Myths / Misconceptions

**UNIT - IV**

Pedagogical Issues

a) Meaning, goals and significance.
b) Challenges of teaching adolescence education: understanding student's behavior, dealing with personal self-constraints, socio- cultural issues, class-room issues and challenges, material production, methodology
c) Preparation of teachers
d) Approaches to adolescence education: case studies and critical incidents, brainstorming, role-playing, gaming, value clarifications, question box, discussions and debates, puppet shows, role reversal, video shows.

**Suggestive Practicum**

- Case studies and Field visit(s).
- Review and analysis of the work done by Government and Non-Government orgnaization.
- Study of Organizations (NGO) at national and international level.
- A research study or detailed case study: Adolescents' behavior in different socio-economic settings, a study on child abuse victims, adolescents in drug rehabilitation centers, adolescents residing in the precincts of industrial areas and factory establishments, adolescents in the educational regions showing either higher or lower drop-out rate, adolescents belonging to communities in which social evils affecting them are manifested like child marriages, conducting Adolescence Education sessions in School.

**Suggestive Mode of Transaction**

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

**Suggestive Mode of Assessment**

The assessment will be based on the tests and assignments.

**Suggestive Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning content.

**EDFE-801 B: Art in Education**

| | |
|---|---|
| Credits: 3L+1T+0P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

The course seeks to develop an understanding of Art with special reference to its relevance in human life in general and Education in particular. It will further develop imagination and sense of appreciation and aesthetic of art. The theoretical considerations of Art Education are highlighted from Indian and western perspectives of art in Life. The course talks about the fundamental principles of Art Education at school level. The pedagogical issues of art education and approaches to teaching-learning process are also discussed.

**Course Learning Outcomes**

After completion of this course, student teachers will be able to:

- develop art appreciation with special reference to relevance and place of Art in human life,
- acquaint with conceptual understanding of the key ideas of Art Education,
- discuss critically the value development in Art Education.,
- understand the implications of Art in Education,
- sensitize towards the problems and issues in Art Education,
- sensitize towards pedagogical issues of Art Education,

**UNIT - I**

Art and Education

a) Conceptual clarity, relationship, and significance of studying art education with special reference to place of art in Human life.
b) Historical development of art education in school education.
c) Goals of studying art education in school curriculum at different stages.
d) Studying art education across the curriculum.
e) Perspective of NEP, 2020 on Art Education.

**UNIT - II**

Theoretical Consideration of Art Education

a) Philosophical, psychological and sociological perspective of Art Education.
b) Formal and informal theories of art.
c) Indian perspective of art in life.
d) Western perspective of art in life.
e) Critical analysis of theories of Art Education.

**UNIT - III**

Fundamentals of Art Education

a) Literature of Art Education
b) Conceptual clarity of the following basic concepts of art at school level: aesthetics, criticism and judgement at school level, beauty, reality, idea, truth, taste, sense.
c) Basic requirements of teaching-learning art at school across stages.
d) Question of social ethics.

**UNIT - IV**

Pedagogical Issues of Art Education

a) Approaches to teaching-learning process of Art Education.
b) Curriculum of art education with special to challenges of developing curriculum.
c) Material production and its challenges.
d) Assessment and Evaluation strategies with special reference to challenges.
e) Criterion of analyzing: curriculum of Art Education, teaching-learning material, assessment and evaluation strategies, teaching strategies of art at school level.
f) Values in Art teaching.

**Suggestive Practicum**

- Preparing multimedia material for Art Education in senior secondary schools.
- Preparation of instructional material for education in the arts for secondary school.
- Organizing the Art Club.
- Case studies of the children's work of art and their understanding of the concept of Art.

**Suggestive Mode of Transaction**

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

**Suggestive Mode of Assessment**

The assessment will be based on the tests and assignments.

**Suggestive Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning content.

**EDFE-803 C: Education for Mental Health**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.

- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

This course on Education for Mental Health will give a comprehensive understanding on the concept of meaning and determinants of Mental Health. The course will further enhance the student teacher's ability to know different stress management and adjustment techniques. The course aims to introduce historical and contemporary developments of Mental Health Education programs in Indian and Global perspectives.

**Course Learning Outcome**

After studying this course, student teachers will be able to:

- express the meaning and significance of mental health,
- describe social and psychological determinants of mental health,
- analyze the causes of stress and process of stress management,
- analyze the significance of adjustment in life,
- analyze the needs and importance of global mental health education programme,
- explain the special role of teachers and parents to maintain the good mental health of children,
- suggest prevention and promotional measures to maintain good mental health of society,
- express the need for health policies globally.

**UNIT - I**

Mental Health

a) Meaning and determinants of Mental Health.
b) Mental Health Vs Mental Hygiene.
c) Mental disorders: Characteristics and Types.
d) Causes of poor Mental Health.
e) Myths Vs Facts about Mental Health.
f) Legal perspectives of Mental Health in India.
g) Concept of Healthy Personality

**UNIT-II**

Stress, Stress Management and Adjustment

a) Stress: meaning, nature and symptoms, types of stress, social and psychological perspectives, remedial measures.

b) Stress management and adjustment: meaning and significance of stress management and adjustment, prevention and promotion, role of parents, peer group and teachers.

**UNIT - III**

Mental Health Education Programme

a) Meaning and significance of Mental Health Education Programme.
b) Dimensions of Mental Health Education Programme in India.
c) Historical development of Mental Health Education Programmes in India.
d) Local and Global Perspective of Mental Health Education Programme.
e) Organizations at local and international level.
f) Characteristics of a good Mental Health Education Programme.
g) Role of Educational Institutions.

**UNIT - IV**

Challenges to Pedagogical Issues

A. Home Vs. school
    - Diverse school and home contexts
    - Lifestyles of teachers and parents
    - Stereo-type roles
    - Mental health concerns of teachers and parents
    - Material availability/ production
B. Guidance and Counselling Programme:
    - Concept, need and techniques.
    - Teacher as a counsellor
C. Designing and evaluating Mental Health Programmes

**Suggestive Practicum**

- Visiting of Mental hospital and preparing list of four cases admitted in Hospital.
- Preparation of two case histories on causes of abnormal behavior.
- Critical analysis of laws and Public Health Policies.
- Critical analysis of National Educational Policy, 2020 in the context of Health of children at school.
- Critical analysis of Legal perspectives Mental Health Education in India.
- Preparing comprehensive report on Mental Health Education Programme in India.

**Suggestive Mode of Transaction**

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

**Suggestive Mode of Assessment**

The assessment will be based on the tests and assignments.

**Suggestive Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning content.

**EDFE-803 D: Education for Sustainable Development**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

This course is designed to highlight the meaning, nature and significance of Education and Sustainable Development in the light of 17 sustainable development goals envisaged in United Nations agenda. The course is designed to make student teachers aware and understand SDG 4 goal of Inclusive and Quality Education in the light of NEP 2020. The course also highlights the politics and policies involved in Sustainable Development.

**Course Learning Outcome**

After studying this course, student teachers will be able to:

- clarify the meaning and significance of sustainable development,
- explore the relationship among education, development and environment,
- appreciate the relation between education and sustainable development,
- describe the characteristics of ESD,
- explain the role of education in sustainable development,
- critically analyze the meaning and importance of education in the context of sustainable development.,
- explain the role of education to achieve sustainable development,
- analyze the pedagogical issues related to ESD.

**UNIT - I**

Education and Sustainable Development

a) Meaning, relationship, goals, and significance.
b) Characteristics of ESD
c) Education for Sustainable Development: Historical Perspective
d) Philosophical, Sociological and Psychological Perspective.
e) Role of Education for Sustainable Development.
f) Decolonizing Knowledge for Sustainable Development.
g) Challenges of Education for Sustainable Development.

**UNIT - II**

Sustainable Development Goals (SDGs)

a) Meaning, nature and significance of SDGs.

b) 17 Sustainable Development Goals (SDGs): UNESCO agenda.
c) SDGs and Social Transformation as Universal Commitment.
d) Education as a Human Right to achieve Sustainable Development.
e) Sustainable Development and Peace.
f) Role of Educational Institutions and Challenges to achieve SDGs.

**UNIT - III**

SD Goal-4: Quality Education for All

A. Meaning, Nature, and Significance.
- NEP, 2020 on SDG-4: Sustainable lifestyle, Gender equality, Promotion of peace & non-violence, Global citizenship, Good mental health & wellbeing, Justice in society.

B. Pedagogical issues for SDG-4.

**UNIT - IV**

Sustainable Development: Politics and Policies

a) Understanding the Policy-Making Process.
b) Policy Analysis.
c) Democratizing Science and Technology.
d) Globalization and the Environment: Capitalism, Ecology and Power.
e) Perspectives, Methods, and Skills.
f) Innovation for Sustainability.
g) Key Issues from an International perspective.
h) Critical issues involved in sustainability.

**Suggestive Practicum**

- To present critical review on NEP, 2020 in the context of SDGs.
- Critical study of Delors Commission Report, 1996: Learning: The Treasure within with reference to SDGs.
- To review and present a critical report on legal perspective on SDGs.
- To prepare Toolkit for Educations for Sustainable Development.
- To organize discussions/ seminars of Teachers of all streams to present their views on SDGs and to present Action Plan for this.
- To prepare and present a short Video/film to promote SDGs.

**Suggestive Mode of Transaction**

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

**Suggestive Mode of Assessment**

The assessment will be based on the tests and assignments.

**Suggestive Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning content.

## EDFE-803 E: Emerging Technologies in Education

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

The course is designed to use Information and Communication Technology in a classroom as an important 21st century skill and an important step for ICT enabled education of the country. The course explores various ICT approaches and its integration in Pedagogy, Assessment and Management. The course will help student teachers to know and apply online and offline software applications and it will enhance their understanding related to social, economic, and ethical issues associated with the use of ICT.

**Course Learning Outcome**

After studying this course, student teachers will be able to:

- describe the need and uses of technology in the field of education,
- use various digital technologies for creating the resources,
- provide learning experiences for all types of learners including differently abled.
- create learning environment in the class room,
- understand the role of ICT to enhance the creativity of students,
- view the use of massive open online courses (MOOCs),
- explain the role of ICT in authentic and alternative assessment,
- discuss the social, economic, and ethical issues associated with the use of ICT.

**UNIT - I**

Education and Technology

a) Relationship between Education and Technology.
b) Conceptual clarity of Technology of Education and Technology in Education.
c) Meaning, Nature, and significance of Technology in Education.
d) Historical Development of use of Technology in Education.
e) Principles of using Technology in Education.
f) Emerging trends in Technology in Education.

**UNIT - II**

Information and Communication Technology

a) Meaning, nature, and types.
b) Fundamentals of Information and Communication Technology.
c) ICT Tools and application.
d) Hardware and Software: meaning, difference and types.
e) System software and Application software.
f) ICT application and multiple intelligence.
g) Social, Economic, and Ethical issues associated with the use of ICT.

**UNIT - III**

Technology in Education and Pedagogy

a) Approaches of integration of Technology in teaching and learning.
b) Subject specific ICT tools for creating and facilitating learning.
c) Subject specific online resources and their uses in lesson Planning.
d) Technology integrated learning experiences and creating learning Environment.
e) Use of Technology for children with special needs: Tools and processes; Universal Design for Learning.
f) Massive Open Online Courses (MOOC)-Concept and use.
g) ICT for Assessment and Management.

Online and Offline Software Applications

a) Application software- meaning and types.
b) Word processing, spreadsheet, presentation: Features and educational applications.
c) Drawing tools – diagrams, concept maps, timelines, flow charts. Educational applications of these tools.
d) Web 2.0 technology and tools: meaning characteristics and types.
e) Social networking and social book marking: Educational Applications.
f) Blog and micro blog – reflective journaling and other educational applications.
g) Wiki, YouTube, TED, Skype – collaborative authoring and projects.
h) Instant messaging and its educational applications.
i) Online forums/discussion groups and chats: educational applications. J. Social media sharing – video, presentations, audio (podcasts), graphics, and text. K. Web 2.0 tools for creating, sharing, collaborating, and networking.

**UNIT - IV**

Instructional Design and E-content

a) Instructional Design: concept, principles, models, and stages.
b) E-learning courseware (e-content) design.
c) Identifying and organizing course content: need analysis (learner, content, and task), learning objectives and course sequence.
d) Designing instructional media, evaluation, and delivery strategies.
e) Creating interactive content: story board, courseware outline, interactivity, and interface
f) Courseware delivery and evaluation.
g) Multimedia tools: Audio editing, video editing, screen casting, graphic editing, and basics of animation, and creating interactive media.
h) Reusable learning objects (RLO) – meaning, types and characteristics, RLO repositories, metadata and standards.
i) E-content authoring tools- open source and proprietary alternatives.
j) Open Educational Resources – Meaning and importance, various OER initiatives, creative common licensing.

**Suggestive Practicum**

- Creating an account in wikispace/wikipedia/mediawiki and adding/editing content.
- Developing an educational blog in www.blogger.com, www.wordpress.com.
- A critical study of some e-learning course.
- Developing a multimedia e-content for a topic.
- Field visits to the EDUSAT center and take part in teleconferencing.
- Planning and creating digital rubrics for any topic
- Organizing web conferencing using Skype/Yahoo/ Messenger/ Google+.

- Interview of computer hardware engineer/ICT specialist regarding Hardware planning, evaluation, maintenance, and up gradation
- Review of NEP, National ICT policy and curriculum in the context of Technology in Education.
- Enrolling and completing some MOOC courses of interest.
- Developing technology integrated unit/lesson plans and trying them out in schools.

**Suggestive Mode of Transaction**

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

**Suggestive Mode of Assessment**

The assessment will be based on the tests and assignments.

**Suggestive Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning content.

**EDFE-803 F: Gender Education**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

The course Gender Education seeks to develop understanding and interlinkages between gender and education. The course is designed to develop a conceptual understanding of the overall gender discourse with special emphasis on issues such as gender bias, gender stereotypes in school, curriculum and in textual materials. The course also addresses gender sexuality, sexual violence, abuse, and legal perspectives.

**Course Learning Outcomes**

After completion of this course the students will be able to:

- clarify key concepts like gender, transgender, gender bias, gender stereotype, empowerment, gender parity, equity and equality and patriarchy,
- explain the shifting from women studies to gender studies,
- clarify gender issues in school, curriculum, and textual materials across disciplines, pedagogical processes and its intersection with class, caste, religion, and region,
- examine school environment, curriculum, and pedagogy with reference to gender related issues,
- address issues related to sexuality, sexual violence, and abuse,
- draw framework for gender sensitized classroom and school environment.

**UNIT - I**

Gender and Education

a) Meaning, relationship, and significance of studying.
b) Conceptual clarity of related terms: Gender, gender perspective, sexuality, patriarchy, masculinity, feminist, gender bias, transgender, gender stereotyping and empowerment.
c) Gender as the basis in school education.
d) Constitutional Provisions with special reference to equity and equality, rights of girls.
e) Education and women's empowerment.
f) Shifting from women's studies to Gender Studies.

**UNIT - II**

Learning Gender Roles

a) Social and Cultural Perspectives of Gender Identity: role of family and school, media, and other formal and informal organizations/ agencies
b) Socialization and learning gender roles.
c) Gender stereotyping/Role models.
d) Preventing Measures: role of school and home

**UNIT - III**

Gender, Sexuality, Sexual Violence and Abuse

a) Development of sexuality and its impact on children with reference to gender, body image, role-models.
b) Sexual violence in formal and informal institutions.
c) Child sexual abuse from pre-primary stage to secondary stage: providing accurate information on child sexual abuse, helping, and identifying signs of sexual abuse in children.
d) Providing dos and don'ts about sexual abuse.
e) Legal perspective: Laws for safety and Security of girls and women, Implementation of the POCSO Act.

**UNIT - IV**

Pedagogical Issues

a) Analyzing classroom practices.
b) Creating gender friendly classrooms and school environment.
c) Analyzing Curriculum from gender perspective: learning outcomes, textual material, teaching-learning processes, language used, teaching aids and assessment strategies.
d) ICT pedagogy for gender sensitive school curriculum.
e) Challenges for pedagogical issues.

**Suggestive Practicum**

- Preparing a Report on National Educational Policies, (1986/1992 and2020) in the context of gender issues in Education.
- Preparation of projects on:
    - Analysis of textual materials from the gender perspective for identifying gender bias and gender stereotype in textual materials.
    - Recommendations of commissions and policies on education to empower girls/women.
    - Mahila Samakhya Programme.
    - Women Role Models in various fields with emphasis on women in unconventional roles.
    - Video clipping on portrayal of women.
    - Folklores reflecting socialization process.
    - How students perceive sexuality and their own body images.
- Field visits to schools to observe the schooling processes from a gender perspective.
- Preparing Analytical Report on portrayal of men and women in print and electronic media.

**Suggestive Mode of Transaction**

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

**Suggestive Mode of Assessment**

The assessment will be based on the tests and assignments.

**Suggestive Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning content.

## EDFE-803 G: Guidance and Counselling

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |

| | | | |
|---|---|---|---|
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

This course comprises of four units aiming to develop the understanding about the concept, need and significance of guidance and counselling. It will give a comprehensive understanding of guidance and counselling principles, techniques, and real-world applications. This course also deals with psychological testing and diagnosis in counselling. It examines the factors affecting guidance and counselling along with ethical considerations. The importance of counselling for individuals with disabilities, visual impairment, and hearing impairment is also emphasized in this course along with challenges related to providing counselling services in schools.

**Course Learning Outcomes**

After completion of this course the students will be able to:

- explain the basic meaning, need and significance of Guidance and Counseling in the context of education,
- differentiate between Guidance and Counselling with special reference to the purpose and strategies,
- clarify the general social, psychological, and historical perspective of Guidance and Counselling,
- describe the basic features of Guidance and Counseling with reference to students needs at school level,
- explain the basic principles of Guidance and Counselling,
- organize guidance program,
- analyze the reports of educational commission and educational policies with reference to Guidance and Counselling.

**UNIT - I**

Guidance

a) Meaning, need, nature and scope of Guidance.
b) Brief historical background of Guidance movement in India.
c) Individual and Group Guidance.
d) Basic assumptions and principles of Guidance.
e) Need to understand the needs of the individual and group in the context of Guidance.
f) Essential information for Effective Guidance.
g) Vocational Guidance and Role of teachers.

**UNIT - II**

Counselling

a) Meaning, importance, areas, and types of Counselling.
b) Approaches to Counseling: directive, non-directive and eclectic, behaviorally, and cognitively oriented.
c) Process of Counseling: initiating counseling, preparation, and intake procedures, establishing rapport, termination of and response to initial interview.
d) Establishing Structure: attending behaviour, observation, non-verbal behaviour, listening, verbal patterning and communication responses, silence, use of questions. Transference and countertransference. regarding and respect in counseling relationships. Involuntary clients, client expectation.
e) Role of family and community.

**UNIT - III**

Tools and Techniques to Collect Data

a) Psychological Testing and Diagnosis: Need and Nature.
b) Test use and interpretation, appraisal techniques.
c) Counseling Interview: Essential aspects, basis procedures, problems, and their handling.
d) Personality Assessment: Historical perspective
e) Material administration, scoring, interpretation, and evaluation of frequently used personality inventories/ questionnaire and projective tests. Personal Orientation Tests and Rating Scales: Type a behaviour, Locus of Control, Attitude scale, ST AI etc., and other clinical rating scales.
f) Case Study: Need and Importance.

**UNIT - IV**

Issues Related to Guidance and Counselling

a) Factors affecting Guidance and Counselling.
b) Ethical issues in Guidance and Counseling.
c) Limitation of diagnosis with special reference to Counselling.
d) Challenges to organize Guidance and Counselling programmes in schools.
e) Counselling and Guidance of persons with learning disabilities, visual and hearing impairment.
f) Challenges related to counselling services in schools.

**Suggestive Practicum**

- Prepare a case study on students with learning difficulties.
- Prepare a report on challenges of organizing guidance and counselling programmes in school.

**Suggestive Mode of Transaction**

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

**Suggestive Mode of Assessment**

The assessment will be based on the tests and assignments.

**Suggestive Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning content.

**EDFE-803 H: Peace Education**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

The course is designed to develop a holistic and critical understanding of the theoretical and practical bases of peace education in National and Global perspectives both. The aim is to inculcate values and attitudes required to become a reflective peace practitioner who promotes peace and harmony in society. The course further enhances the contribution of various leaders or educationists in promoting culture of peace.

**Course Learning Outcomes**

After the completion of this course students will be able to:

- acquire a holistic and critical understanding of the theoretical and practical bases of peace education,
- trace the historical development and status of the peace education field,
- searching and identifying the best ways to follow peace in life,
- show ability to select and use appropriate method of resolving conflict,
- become critical learners and reflective peace practitioners,
- appreciate the foundations of just and peaceful societies,
- understand and practice the positive action and non-violent conflict resolution in society,
- enhance students' intellectual flexibility, creativity & problem-solving capacities,
- connect course content to current public events and issues worldwide.

**UNIT - I**

Peace Education: Nature and Significance

a) Peace and Peace Education.
b) Meaning, need, dimensions and goal of Peace Education.
c) A brief review of Historical Development of Peace Education.
d) Philosophical, sociological, and psychological perspectives of Peace Education.
e) Types of Peace: positive, negative, inner, social and with nature.
f) Conflict-Resolution and Peace Education.
g) Relationship between Development and Peacebuilding.
h) Learning from experiences to explore the scope of Peace Education.
i) Challenges to Peace Education.

**UNIT - II**

Towards the Global Culture of Peace

a) Process of Peacebuilding.
b) Culture of Peace Vs Culture of War.
c) Approaches to Peace Education.
d) Conflict Analysis and Resolution.
e) Role of Social and Religious Foundations in Peacebuilding.
f) Role of local and International Agencies in the Peacebuilding process.
g) Contribution of Mahatma Gandhi, Tagore, Shri Aurbindo and Dalai lama to build the Culture of Peace at Global level.

**UNIT - III**

Thoughts on Peace and Harmony

a) Ancient Indian views.
b) UNO role for Global Peace Education.
c) Constitutional provisions.
d) Study of following thinkers in context of global Peace and Harmony: J. Krishnamurti, Sri Aurobindo, Rabindra Nath Thakur, Mahatma Gandhi, Montessori, Russell, Dalai Lama.

**UNIT - IV**

Pedagogical Issues for Peace Education

a) Assessing curriculum policy for social and civic reconstruction.
b) Comparative and historical perspective on school knowledge and peace.
c) Socio-historical processes on curriculum change.
d) Teachers' perceptions of the effects of young people's war experiences and pandemic.
e) Critical analysis of school curriculum at school level in the light of peace building process.
f) Challenges of Pedagogical issues of Peace Education.

**Suggestive Practicum**

- Critical analysis of Educational Policies, Curriculum and Text Material for Peace-building Process.
- Reflection on Human Rights, with special reference to Constitution of India, as a process of Social-cohesion and Peace.
- Analyzing the Role of UNESCO in the context of Peace at Global level.
- Collection of statements, shloka or sukti (Good Sayings) from ancient Indian literature related to inner and Social Peace.
- Study of Yoga-Darshana as a process of Peace and Harmony.

**Suggestive Mode of Transaction**

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

**Suggestive Mode of Assessment**

The assessment will be based on the tests and assignments.

**Suggestive Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning content.

**EDFE-803 I: Sports and Fitness Education**

| | |
|---|---|
| Credits: 3L+0T+1P | Marks 100 |
| Contact hours per week: 5 | C1+C2=30 |
| External Examination:3hours | C3=70 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| Distribution Marks for the course | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 15 | 1hr | 40 |
| Internal Test (C2) | 10+5 | 1hr | |
| External Examinations | 70 | 3hr | |
| **Total Marks** | 100 | | 40 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

The course seeks to develop a comprehensive and holistic understanding about the concept of health, its various dimensions, and determinants. The course traces the evolution of Health and Physical Education, historical development of the discipline with special reference to Indian Education and its relation to other subjects. It further highlights the importance of physical fitness policies, programs and services addressing health initiatives in school context.

**Course Learning Outcomes**

After completion of this course the students will be able to:

- understand the concept of holistic health, its various dimensions, and determinants,
- develop positive attitude towards health physical education and yoga as individual,
- sensitize, motivate, and help them to acquire the skills for physical fitness, learn correct postural habits and activities for its development,
- create interest for the practice of yogasana and meditations,
- understand various policies and programmes related to health, physical education and yoga,
- help them to understand the process of assessment of health and physical fitness.

**UNIT - I**

Evolution of Health and Physical Education

a) Health and Physical Education: Conceptual Clarity (locally as well as globally), importance and aims.
b) Place in School Curriculum: Historical Development as a subject, Objectives with special reference to Indian Education and its relationship with other subjects.
c) Status of Health and Physical Education: From primary to secondary education in a global perspective, ayurvedic and yogic concept of Health Education, legal perspective of Health and Health Education in India.

**UNIT - II**

Health Education

a) Concept, dimensions, and determinants of health with special to India.
b) Psycho-social concerns of children and adolescents including differently able children.
c) Understanding the body system and its functions
d) Common health problems and diseases: causes, prevention and cure, immunization and first aid.
e) Impact of Physical activities, games, sports and yoga on different body systems.
f) Food and nutrition, nutrients and their functions.

**UNIT - III**

Games and Fitness

a) Physical fitness and its components: athletics (general physical fitness exercises), games (lead-up games, relays, and major games), Rhythmic activities, gymnastics, and their impact on health.
b) Development of physical fitness: Postures and Importance of relaxation, Fitness tests; Resources and services for games and sports and Health.
c) Fundamentals skills of sports: Sports for recreation and competition, Sports awards and scholarships, sport person ship, Indigenous and self-defense activities.
d) School and family, health services, policies and major health and physical education-related programmes, blood banks, role of media.
e) Safety and security.

f) First Aid: Need and Principles.

**UNIT - IV**

Policies, Programmes and Assessment

a) Policies, programmes, and services for addressing health needs.
b) School Health Programme: school health services, health promoting schools, global school health initiatives.
c) Yoga: Meaning, initiation, historicity, classification, streams, and schools of yoga, Need and importance and role of yoga for healthy life and living, Yoga as psychotherapy.
d) POCSO (Protection of Children from Sexual Offences Act, 2012), PWD 2016, the Integrated Child Protection Scheme.
e) Assessment of health performance testing in games and sports, reporting of health condition and performance of child in the sport fields.

**Suggestive Practicum**

- Recognizing important indicators of health and wellbeing of children and mental health.
- Undertaking a survey, understanding local food related matters, and understanding the importance of the right to food.
- Analyzing NEP, 2020 with reference to Games Oriented Education.
- Planning activities for development of physical fitness.
- Organization of games and sports tournaments
- Learning and performing basic yogic activities, asanas, and pranayama, Kriyas and Meditation. Celebration of yoga day, yoga week.
- Arranging reflective Dialogues on Serials and related videos.
- Preparation of inventories on myths on exercises and different types of food.
- Preparation of First Aid kit.
- A critical review of YOGA-SUTRA.

**Suggestive Mode of Transaction**

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.
- Hands on experience of engaging with diverse communities, children, and schools.

**Suggestive Mode of Assessment**

The assessment will be based on the tests and assignments.

**Suggestive Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning content.

**AEVA-801: Yoga and Understanding Self**

| | |
|---|---|
| Credits: 1L+0T+1P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.

- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

This course focuses on the benefits of Yoga for healthy living and the importance of the practice of yoga for promoting the optimal state of physical, emotional, intellectual, social, and spiritual wellbeing of a person. Yoga as a way of life is characterized by peace and tranquillity, harmony and health, love and happiness, precision, and efficiency. The course seeks to engage student teachers with these ideas. The focus of the course is on being mindful of self (body, mind, emotions, thoughts, and actions). Course components will include brief history of yoga, principles and different types and streams of yoga, practices (Kriyas, Āsana, Prāṇāyāma, Bandha & mudra, Dhāraṇa & Dhyāna, etc), meditation and reflective practices, and the importance of these aspects in becoming an effective teacher. It lays equal weightage to the theory and practicum.

**Course Learning Outcomes**

After completion of the course, the student teachers will be able to

- explain the importance of Yoga and how it helps an individual in understanding Self,
- describe the importance of practicing Yoga Asana,
- practice basic Yoga Asanas/ Kriyas.

**UNIT - I**

Philosophy and Historical Perspective of Yoga

A. Concept and Meaning of Yoga, Philosophy of Yoga,
B. Brief history and development of Yoga (Classical Yoga, Post Classical Yoga and Modern Period)
C. Importance of Yoga for healthy living, Yoga and its relevance in the modern times, Traditions in Yoga.

**UNIT - II**

Schools of Yoga

A. Different streams \schools of Yoga (Gnana, Bhakthi, Karma).
B. Construction of Yoga Practice for all round development.
C. Principals of Yoga: - Ahimsa, Satya, Asteya, Brachmacharya, Aparigraha, Shoucha, Santhosha, Tapas, swadyaya and Isvara Paridhana.

**UNIT - III**

Modern Principles of Yoga and Meditation

A. Modern Principles: Human Body is a holistic entity, Individuals and their need are Dhāraṇa & Dhyāna, etc, meditation and reflective practices, and the importance of these aspects in becoming an effective teacher, unique Self-empowering, the quality and state of an individual mind is crucial to healing.

B. Meditation: - its Importance, Types, and Process, Pranayama: its importance, types and process, Yoga as a Way of life for Peace, Harmony, Health love and happiness. Yoga in Indian philosophy for understanding Self.

**Suggestive Practicum**

- Practice of Basic Yoga Asanas/ Kriyas.

**Suggestive Mode of Transaction**

Reflective reading of different Yoga practicing Personalities, Learning by doing, Relaxation Techniques for imparting concentration, Understanding Self and personality development.

**Suggestive Mode of Assessment**

Assessment of practicum; Assessment of practice of basic Yoga Asanas/ Kriyas; Assessment of Reflective level Readings.

**Suggested Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning content.

## AEVA-802: Citizenship Education, Sustainability and Environmental Education

| | |
|---|---|
| Credits: 1L+0T+1P | Marks 50 |
| Contact hours per week: 3 | C1+C2=10+5 |
| External Examination:2hours | C3=35 |

- Pattern of question paper aimed to examine higher order thinking, critical, thinking and analytical reasoning pertaining to the concerned subjects.
- Each question paper will be divided into two parts viz A and B. Questions of each section will cover all the units of the paper. Part A is compulsory and part B with internal choices and need to attempt one question from each unit.
- Part-A will consist of 10 compulsory questions from all the units. These questions will be short answered.
- Part B will consist of 2 questions of long answer type (300 words) from each unit with internal choices.
- Each question of part A will carry 2 marks with a total of 20 marks. Questions of part B will carry remaining proportion of the maximum marks of the paper.
- The overall question paper will have difficulty level as Easy 30%, Average: 40% and Difficult: 30%

| **Distribution Marks for the course** | | | |
|---|---|---|---|
| Paper | Max.Marks | Duration | Min. Pass Marks |
| Internal Test (C1) | 10 | 1hr | 20 |
| Internal Test (C2) | 5 | 1hr | |
| External Examinations | 35 | 2hr | |
| **Total Marks** | 50 | | 20 |

Note: C1: Written Test as per schedule (at the end of 8th week)
C2: As per class schedule -Written test/Assignment/ Eassy/ Presentation / Report/Project/ Seminar/ Quiz etc.(at the end of 15th Week).

**About the Course**

This course seeks to orient student teachers to the Constitution of India with a particular emphasis on Fundamental Rights and Fundamental Duties, and to prepare them for their roles and responsibilities as responsible, productive, and effective citizens of India. The course also seeks to enable student teachers to understand the interconnected and interdependent world, India's rich heritage and philosophical foundation of "Vasudaiva Kutumbakam" (Whole

world is one family), acquire the knowledge, capacities, values, and dispositions needed to understand global issues and become active promoters of more peaceful, harmonious and sustainable societies. The course also seeks to create among student teachers an awareness of responsible global citizenship required for responding to contemporary global challenges.

The sustainability aspect of the course seeks to develop among student teachers an understanding of the idea of 'Sustainability' in all fields of human activities, including achieving sustainable development in its three dimensions – economic, social, and environmental – in a balanced manner. The environmental education component of the course aims at creating an awareness among student teachers of environmental issues, including actions required for mitigating the effects of climate change, environmental degradation and pollution, and initiatives required for effective waste management, conservation of biological diversity, management of biological/natural resources, forest and wildlife conservation, and sustainable development and living. The course will also deepen the knowledge and understanding of India's environment in its totality, their interactive processes, and effects on the future quality of people's lives.

**Course Learning Outcomes**

After completion of the course, student teachers will be able to:

- explain the concept of citizenship and citizenship education,
- describe the aims of and approaches to citizenship education,
- explain the concept and aims of Global Citizenship and Global Citizenship Education,
- describe the aims of and approaches to global citizenship education,
- explain the concept of 'Sustainability' in all fields of human activities, and approaches to achieving sustainable development in its three dimensions – economic, social and environmental – in a balanced manner,
- demonstrate an awareness of environmental issues, and actions required for mitigating the effects of climate change, environmental degradation and pollution, and initiatives required for effective waste management, conservation of biological diversity, management of biological/natural resources, forest and wildlife conservation, and sustainable development and living.

**UNIT - I**

Citizenship Education

a) Concept of citizenship and citizenship education.
b) Aims of and approaches to citizenship education.
c) Concept of Global Citizenship and Global Citizenship Education.
d) Aims of and approaches to global citizenship education.
e) Concept of Vasudhaiva Kutumbakam, its importance in development of a holistic perspective towards local and global communities.

**UNIT - II**

Sustainability

a) Concept of 'Sustainability' in all fields of human activities.
b) Approaches to achieving sustainable development in its three dimensions – economic, social, and environmental.
c) Sustainable development goals.
d) Sustainable management of natural resources.
e) School- and community-based activities.
f) Education for sustainable development

**UNIT - III**

Environmental Education

a) Environmental issues.
b) Actions required for mitigating the effects of climate change, reducing environmental degradation, pollution etc.
c) Initiatives required for effective waste management, conservation of biological diversity, management of biological/natural resources, forest and wildlife conservation, and sustainable development and living.
d) Approaches to delivering Environmental Education

e) Role of Mass Media and Technology in delivering environmental education.
f) Roles Governmental and Non-Governmental Organizations in promoting Environmental Education.
g) School and community-based environmental education activities.

**Suggestive Practicum**

1. Write a report on the roles of governmental and non-governmental organizations in promoting Environmental Education.

**Suggestive Mode of Transaction**

Lecture-cum- discussion, Focus Group discussions, in-class seminars, Library Work, Assignments, Project Work, Lesson Plan Development, Interaction with different stakeholders, ICT based educational materials, Group Work, critical reflections, group-work, case-based approaches, and enquiry-based learning.

**Suggestive Mode of Assessment**

Assessment of practicum and assessment of reflective level readings

**Suggestive Reading Materials**

Teachers may suggest books/readings as per the need of the learners and learning content

## EDSE-801: School Based Research Project (Post Internship)

| Credits: 1L+0T+1P | Marks 50 | Minimum Pass Marks |
|---|---|---|
| Contact hours per week: 3 | | 20 |
| Internal Evaluation (post internship at the Institute) | 50 | |

**About the Course**

After successful completion of internship programme in 7th semester, student teachers compile the learnings, discuss with peers about their experiences, reflect on the experiences, refine the artifacts developed during internship and prepare comprehensive internship report during post internship in 8th semester.

**Course Learning Objectives**

After completion of the activities, the student teachers will be able to:

- develop comprehensive understanding of the school ecosystem,
- describe their learning from internship with the peers and teacher educators,
- reflect on school internship sharing learning experiences on each activity undertaken.

**Suggestive Mode of Transaction**

- Discussion
- Presentation, Gallery walks and Exhibition.
- Report Writing

**Activities:**

**Experience Sharing and Reflective Learning**

- Presentation of reflective journal summary
  - My Learning Journey: by each student-teacher
- Gallery walks (Exhibition): TLMs, display of participation in school activities (photos/stories) and other artefacts created during the internship by student teachers.
- Sharing of best practices (PPTs, Videos.)
- Survey and collect the local stories and rhymes from the parents and community (in the context of the secondary stage)
- Holding a training workshop for the parents and community and encouraging them to act as volunteers.
- Awareness and advocacy programme in FLN for parents and community: Role play with parents and community on conducting specific FLN activities.

- Organizing a parents /community mela/fair on homemade TLM for FS children

**Assessment**

| S.N. | Activities | Maxium Marks |
|---|---|---|
| **1.** | Reflective Journal | **5** |
| **2.** | Lesson Plans and TLMs | **10** |
| **3.** | Observation records (Teacher Educator, Mentor, school heads, Teachers, Parents) | **10** |
| **4.** | Assessment records and Student Portfolio | **5** |
| **5.** | Action research report/case study | **10** |
| **6.** | Comprehensive internship report. | **10** |
| **Total** | | **50** |

**Mode of Assessment**

| Competence/Artifact | Method of assessment | Assessed By | Credits |
|---|---|---|---|
| Artefacts created during the internship. My Learning Journey | Exhibition & Presentation | Teacher-Educator | 1 |
| Comprehensive Internship Report | Review | Teacher-Educator | 1 |

**Course Learning Outcomes**

The student teachers will be able to:

- demonstrate/Exhibit/Manifest comprehensive understanding of the school ecosystem.
- reflect on school internship experiences in a report.
- share their learning from school internship with peers and teacher educators

**EDSE-802: School Based Research Project [Creating Teaching Learning Material (TLM)/ Work Experience]**

| Credits: 1L+0T+1P | Maximum Marks | Minium pass Marks |
|---|---|---|
| Contact hours per week: 3 | | |
| Internal Evaluation (school based research project at the Institute) | 50 | 20 |

**About the Course**

Having developed an understanding of education's philosophical, sociological, and psychological perspectives and gained hands-on experiences from pre-internship school observation and internship phases, the student teachers have developed a comprehensive understanding of education. By utilizing these experiences and understanding, the Student teachers will be in a position to develop/create Teaching Learning Materials (in various forms, Programed Learning Materials, Educational videos, teachers' handbooks, flashcards, story books, toys, games, posters, collages, innovative lesson plans using different pedagogies, to mention a few) which in turn may be helpful to both the school students with whom he/she has interacted during school experiences and the student teachers. Schools provide a systematic teaching environment for the learners to acquire the knowledge, skills and attitude required to meet the varied aspirational needs and educational goals. Work experience fosters basic knowledge, skills and disposition among the students that prepare them to think of becoming skilled entrepreneurs. To orient the school students on work education, the student teachers need exposure to visit the local vocational artisans, crafts person and entrepreneurs and prepare learning resources to enhance their professional skills and competencies. Teaching Learning Materials of good quality with (i) innovations, (ii) the use of low-cost materials, (iii) local context and (iv) modern technology (for digital learning materials) will enhance students' engagement, interest, and practical learning.

**Course Learning Objectives**

After completion of the activities, the student teachers will be able to:

- Assess the need for Teaching Learning Materials and prepare innovative TLM,
- Develop an understanding of the importance of work experience and competencies of a local crafts person, artisans and entrepreneurs,

**Suggestive Mode of transaction**

- Workshop
- Group discussion
- Field visits and interaction
- Analysis of existing local-specific learning resources, toys
- Exhibition of TLM and presentation of reflective reports on the use of learning resources, including toys.

**Content**

- Understanding how students learn at different stages.
- Knowledge of toys and other TLMs from different parts of the countries
- Knowledge of relevant TLMs for specific groups of children- CWSN, kinaesthetic learners, visual learners, auditory learners addressing individual differences.

**Assessment**

| S.N. | Activties | Marks |
|---|---|---|
| 1. | Orientation workshop on work experience and development of learning resources | 5 |
| 2. | Interaction with local artisans, craftspeople, and entrepreneurs. | 5 |
| 3. | Observe Traditional work practices and their integration into Local Technologies and Ideas. | 5 |
| 4. | Analysis of available local specific, indigenous learning resources, including toys and their use in the learning-teaching process | 5 |
| 5. | Development of at least two low-cost learning resources as per the local contexts at secondary stage) and presentation/exhibition | 15 |
| 6. | Prepare the manual of TLM highlighting the objectives that will be achieved by its use, the material used, the process of its development and its use during classroom transaction. | 15 |
| **Total** | | **50** |

**Mode of Assessment**

| Assessment | | | |
|---|---|---|---|
| Competence/Artifact | Method of assessment | Assessed By | Credits |
| TLM developed | Presentation/Exhibition | Teacher Educators (panel of three experts including an external expert) | 1.5 |
| Manual | Presentation | Teacher-Educator | 0.5 |

**Course Outcomes**

The student teachers will:

- demonstrate the use of TLM for enhanced learning,
- explain the importance of work experience and competencies of local crafts person.

**EDCE-801: Community Engagement and Service [Adult Education/Lifelong Learning etc.]**

| Credits: 0L+1T+1P | Max. Marks | Min. Pass Marks |
|---|---|---|
| Contact hours per week: 4 | | |
| Internal Evaluation (community engagement and service programme) | 50 | 20 |

**About the Course**

The curricular component of 'community engagement and service' seeks to expose student teachers to the socio-economic issues in society and community-supported development activities so that classroom learnings can be

supplemented by life experiences to generate solutions to real-life problems. This course is designed to develop insights into the functions of the community, enhance the ability of student teachers to enlist community support to and participation in school-related activities, make the community aware of the importance of education, issues associated with schooling, gender inequity, health & wellness of children, initiatives for supporting lifelong education etc. It aims at sensitizing the student teachers to initiate actions with the support of the community members to address the social, cultural and educational problems, and develop social leadership skills through community service. The component seeks to enable student teachers to be acquainted with various community development initiatives and organize activities such as street plays, advocacy activities, door-to- door campaigns, and prabhat-pheris etc. to mobilize community participation in development initiatives. This curricular component envisages participation of student-teacher in activities undertaken under the National Service Scheme (NSS), New India Literacy Programme, Student the mentoring initiatives, etc. Some of the activities include: Survey of community resources for participation in different school activities, Study of the situation with regard to school dropout and the reason thereof (Stage wise); Survey of a specific settlement to study the socioeconomic and educational status; Survey of non-literates in a specific settlement, including identification of 4-5 non-literate adults who will be supported by student teachers to become literate; training of local youth in First-Aid and other relevant activities; assessment of the situation with regard to Health and wellness of children in a locality, creating awareness of the importance of sustainable development, making the community members aware of the importance of environmental protection, creating awareness of rainwater harvesting, mentoring school students with learning deficits, guidance and counselling to school students etc.

**Course Learning Outcomes**

On successful completion of the 'Community Engagement and Service' programme, the student-teacher should be able to:

- recognize the socio-economic issues in the community and identify initiatives that could help solve problems faced by the community,
- demonstrate an awareness of the functions of the community, and the measures required for enlisting community participation in school-related activities,
- undertake initiatives that are required to make the community aware of the importance of education, issues associated with schooling, gender inequity, health & wellness of children, illiteracy among youth and adults in the community etc.,
- suggest actions in collaboration with community members to address the social, cultural and educational problems in the community,
- organize activities such as street plays, advocacy activities, door-to-door campaigns, and prabhat-pheris etc. to mobilize community participation in development initiatives,
- demonstrate social leadership quality through community services,
- organize interactions between schools and local communities for generating solutions to problems such as dropout and learning deficits,
- facilitate partnerships between local communities to enhance participation of the community in school-related activities such as PTA meetings,
- recognize the fault lines of the society, such as casteism, social taboos and superstitions etc. and work towards bridging them to establish harmony in the society,
- demonstrate positive feelings towards the local community and appreciate traditional knowledge and practices,
- Recognize the values of public service and active citizenship.

**Approach to curriculum transaction**

The student teachers will be provided opportunities to have exposure to community life for ten days in total, two days in Preparation for Community Engagement & Service in the institution, seven days working with the community, and the last day in the institution for sharing their experiences and reflections. The activities may be conducted in groups or individually as appropriate.

**Days 1-2:** Preparation for community services (In the institution)

- Orientation of student teachers on Community Engagement & Services through discussion and group activities.
- Workshop for developing tools for different activities during the programme.

**Days 3-9:** Engagement with the community (Mandatory onsite stay with the community) Students will be divided into smaller groups; They would participate in the planned activities with defined roles for seven days on a rotation basis. These activities include:

- Participation of student teachers in activities undertaken under the National Service Scheme (NSS), New India Literacy Programme, Student mentoring initiatives, etc.
- Survey of community resources for supporting school activities.
- Study of the situation regarding school dropout and the reason thereof (Stage wise).
- Survey of specific settlement to assess the situation about non-literates in the settlement, including identification of 4-5 non-literate youth and adults who will be supported by student teachers to become literate,
- Training of local youth in First Aid and other relevant interventions,
- Assessment of the situation about Health and wellness of children in a locality,
- Creating awareness of the importance of sustainable development, and making the community members aware of the need to support initiatives to ensure environmental protection, creating awareness of rainwater harvesting, mentoring school students with learning deficits, guidance and counselling to school students etc.)
- Visit and interact with local artisans and craftsperson.

The above activities typically will include working with the community, collecting data, playing local games, community awareness programmes like nukkad natak, rallies, organizing and participating in the cultural programmes with the community members etc.

The student teachers shall conduct different pre-scheduled activities throughout the day. Morning sessions will be used for activities with the community and data collection. The afternoon session will be devoted to data analysis and preparation of the report, and participation in games & sports activities. Evening session will involve cultural activities with community members.

**Day 10:** Feedback session and Reflection (: In the Institution)

- Sharing experiences and discussion on activities carried out.
- Presentation and submission of report on the activities carried out.
- Evaluation of the activities by collecting feedback on the effectiveness of the campaign from the mentor and the students.
- Reflection of experience (individual/group) of organizing community service

**Assessment components and weightage**

| S.N. | Assessment components and weightage | Marks |
|---|---|---|
| 1. | Involvement and active participation in activities relating to Community Engagement and Service: (Assessment method: Observation by teacher educator, teacher and community members); Weightage: 75%; Assessed by the teacher educator, teacher and community members), | 35 |
| 2. | Group Report & Reflections: Method of assessment: Presentation by student teachers); Weightage: 25% (Assessed by Teacher Educator) | 15 |
| **Total** | | **50** |

**Suggestive Links**


- Ministry of Education (2021).Vidyanjali: Guidelines for Promoting Community and Voluntary Participation for Enhancing Quality School Education, Government of India. https://vidyanjali.education.gov.in/assets/pdf/Final_Guidelines_Vidyanjali_%20December.pdf
- RIE Bhubaneswar (2020). Handbook on Field Engagement in Pre-service Teacher Education, Bhubaneswar, Regional Institute of Education.
- National Education Policy 2020; Ministry of Education, Govt. of India.