MAHARSHI DAYANAND SARASWATI UNIVERSITY, AJMER

पाठ्यक्रम

SYLLABUS

SCHEME OF EXAMINATION AND COURSES OF STUDY

FACULTY OF SCIENCE

B.Sc. (Hons) Part-I (w.e.f.2009-10)
B.Sc. (Hons) Part-II (w.e.f. 2010-11)
B.Sc. (Hons) Part-III (w.e.f. 2011-12)
(10+2+3) Pattern

सत्र 2013–14

महर्षि दयानन्द सरस्वती विश्वविद्यालय, अजमेर

NOTICE

1. Change in Statutes/Ordinances/Rules/Regulations/ Syllabus and Books may, from time to time, be made by amendment or remaking, and a candidate shall, except in so far as the University determines otherwise comply with any change that applies to years he has not completed at the time of change. **The decision taken by the Academic Council shall be final.**

सूचना

1. समय-समय पर संशोधन या पुन: निर्माण कर परिनियमों /अध्यादेशों / नियमों / विनियमों / पाठ्यक्रमों व पुस्तकों में परिवर्तन किया जा सकता है, तथा किसी भी परिवर्तन को छात्र को मानना होगा बशर्ते कि विश्वविद्यालय ने अन्यथा प्रकार से उनको छूट न दी हो और छात्र ने उस परिवर्तन के पूर्व वर्ष पाठ्यक्रम को पूरा न किया हो। **विद्या परिषद द्वारा लिये गये निर्णय अन्तिम होंगे।**

CONTENTS

SCHEME OF EXAMINATION

The Number of Papers and the maximum marks for each paper together with minimum marks required for a pass are shown against each subjects separately. It will be necessary for a Candidate to pass in the theory part as well as the practical part of the subject of a subject/Paper wherever prescribed separately.
Classification of successful candidate shall be as follows :
of the aggregate candidate shall be as follows :
First Division 60% } (a) Part-I Examination
Second Division 50} (b) Part- II Examination
(c) Part-III Examination

All the rest shall be declared to have passed the examination; if they obtain minimum pass marks each subject viz. 36% no division shall be awarded at the part-I part-II examination.
The number of papers and practicals. Wherever prescribed, the duration of examination. maximum marks and minimum pass marks are shown in the relevant syllabus.
A candidate shall be required to offer one Honours subject and one subsidiary subject out of the following subjects :
Subsidiary Subjects :

1. Physics	2. Chemistry	3. Mathematics
4. Zoology	5. Botany	6. Geology

(The scheme of examination, the course of study and text books for subsidiary subjects of Honours Pt. I, II & Pt. III examination shall be the same as prescribed for the Optional subject of the B.Sc. Part I, II & Pt. III Examination.)

Honours Subjects :

1.Chemistry 2. Mathematics

N.B.:- Candidates shall be required to offer the Four/Five papers and Practicals (wherever prescribed) of the Honours subject offered by him.

DISTRIBUTION OF MARKS

S. No.	Name of the Subjects/Papers		Duration	Max. Marks		Min. Pass Marks
Compulsory Subject :						
1.	General Hindi OR General English English or Elementary Hindi (In lieu of General Hindi) or History of Indian Civilization (In lieu of General Hindi)		3 hrs.	100		36
2.	Elementary Computer Applications		3 hrs.	100		36
3.	Environmental Studies		3 hrs.	100		36
B.Sc. Hons.-Pt.I						
1.Chemistry		Paper I	3 hrs.	75		
		Paper II	3 hrs.	75	300	120
		Paper III	3 hrs.	75		
		Paper IV	3 hrs	75		
		Practical	10 hrs.	100		40
2.Mathematics		Paper I	3 hrs.	80		
		Paper II	3 hrs.	80		
		Paper III	3 hrs.	80	400	160
		Paper IV	3 hrs	80		
		Paper V	3 hrs.	80		
B.Sc. Hons.-Pt.II						
1.Chemistry		Paper I	3 hrs.	75		
		Paper II	3 hrs.	75		
		Paper III	3 hrs.	75	300	120
		Paper IV	3 hrs	75		
		Practical	10 hrs.	100		40

2.Mathematics	Paper I	3 hrs.	80		
	Paper II	3 hrs.	80		
	Paper III	3 hrs.	80	400	160
	Paper IV	3 hrs	80		
	Practical	3 hrs.	80		
B.Sc. Hons.-Pt.III					
1.Chemistry	Paper I	3 hrs.	75		
	Paper II	3 hrs.	75	300	120
	Paper III	3 hrs.	75		
	Paper IV	3 hrs	75		
	Practical	10 hrs.	100		40
2.Mathematics	Paper I	3 hrs.	80		
	Paper II	3 hrs.	80		
	Paper III	3 hrs.	80	400	160
	Paper IV	3 hrs	80		
	Practical	3 hrs.	80		

बी. एस.सी. (ऑनर्स) विज्ञान भाग प्रथम परीक्षा

1. सामान्य हिन्दी

समय 3 घंटे उत्तीर्णांक : 36 पूर्णांक : 100

निर्देश: इस प्रश्न-पत्र के प्राप्तांक श्रेणी निर्धारण में सम्मिलित नहीं किये जायेंगे।

अंक योजना-

(अ भाग)

गद्य एवं पद्य संकलन की विविध विधाएँ क्रमश: (25 + 25 = 50 अंक)

1. एक प्रश्न व्याख्याओं से संबंधित क्रमश: (10 + 10 = 20 अंक)

2. दो परिचयात्मक प्रश्न पाठ्य पुस्तकों से(15 + 15 = 30 अंक)

(ब भाग)

1. शब्द शुद्धि -5 अंक
2. वाक्य शुद्धि -5 अंक
3. पारिभाषिक शब्दावली (अंग्रेजी शब्दों के हिन्दी समानार्थक शब्द) -5 अंक
4. संक्षेपण -5 अंक
5. पल्लवन -5 अंक
6. वाक्यांश के लिए सार्थक शब्द -5 अंक
7. प्रारूप -5 अंक
8. शब्द युग्म: अर्थ-भेद -5 अंक
9. निबन्ध -10 अंक

गद्य-संकलन

1. ग्रामोत्थान- नानाजी देशमुख, दीनदयाल शोध संस्थान चित्रकूट
2. पर्यावरण और सनातन दृष्टि छगन मेहता, संक्रान्ति और सनातनता, संकलन से वागदेवी प्रकाशन बीकानेर
3. ठिठुरता हुआ गणतंत्र (व्यंग्य)- हरिशंकर परसाई, तिरछी रेखाएँ, वाणी प्रकाशन दिल्ली
4. लछमा (रेखाचित्र) महादेवी वर्मा, अतीत के चल चित्र वाणी प्रकाशन, नई दिल्ली
5. अग्नि की उड़ान (परिच्छेद 16) ए.पी.जे.अब्दुल कलाम प्रभात प्रकाशन, नई दिल्ली
6. भेड़ाघाट: मार्बल रॉक्स और धुआँधार - अमृत लाल बेगड़ अमृतस्य नर्मदा ग्रंथ, मध्यप्रदेश अकादमी, भोपाल, मध्यप्रदेश
7. आवाज का नीलाम (एकांकी) धर्मवीर भारती गद्य-प्रभा-डॉ. नवल किशोर पंचशील प्रकाशन, जयपुर
8. सावचेती विजयदान देथा ,आउटलुक पत्रिका 03.10.2005
9. हिन्दी भाषा और उसकी विरासत -डॉ विद्यानिवास मिश्र, हिन्दी साहित्य का पुनरावलोकन विद्या निवास मिश्र, प्रभा प्रकाशन, दिल्ली
10. सुसंग-कुसंग-सीताराम महर्षि, कृष्ण कुटीर, रतनगढ़, चुरू (राज.)
11. ये हैं प्रोफेसर शशांक-डॉ. विष्णुकान्त शास्त्री -'स्मरण को पाथेय बनने दो'संग्रह, लोक भारती, इलाहाबाद (उ. प्र.)
12. तुलसी के काव्य में 'कुराज' और 'सुराज'- प्रो. सूर्य प्रसाद दीक्षित साहित्यिक डी 54, निराला, नगर लखनऊ (उ. प्र.)

पद्य - संकलन

1. गंगावतरण, भारतेन्दु हरिश्चन्द्र 'भारतेन्दु समग्र' संपादक, हेमंत भार्मा हिन्दी प्रकाशन संस्थान, वाराणसी (उ. प्र.)
2. गोवर्धन धारण, हरिऔध 'प्रिय प्रवास' महाकाव्य हिन्दी साहित्य कुटीर, वाराणसी(उ. प्र.)
3. भारत वन्दना मैथिलीशरण गुप्त 'मंगल-घट' काव्य ग्रंथ साहित्य (नीलाम्बर परिधान)सदन चिरगाँव, झाँसी (उ. प्र.)
4. समर शेष है रामधारी सिंह दिनकर 'परशुराम की प्रतीक्षा' ग्रंथ से, राजपाल एण्ड संस, दिल्ली
5. वीरों का कैसा हो बसन्त, सुभद्रा कुमारी चौहान 'सुभद्रा कुमारी चौहान' सम्पादक: सुधा चौहान साहित्य अकादमी, नई दिल्ली
6. चल पड़े जिधर दो डग, सोहन लाल द्विवेदी 'राष्ट्रीय गीत संग्रह' साहित्य अकादमी, नई दिल्ली
7. श्रम दयाकृष्ण विजय 'श्रम-धरा' अर्चना प्रकाशन, अजमेर
8. भारती की साधना इन्दुशेखर तत्पुरूष 'हमारा दृष्टि कोण स्मारिका' 70/75 मानसरोवर जयपुर (राज.)

I. GENERAL ENGLISH

Duration : 3 Min.Pass Marks 36 M.M. 100

Objevtives : This Is Essentially a Language Based Course. It aims at making students read English prose with a view to enlarging their comprehension of the language and encouraging them to develop reading habits. It also aims at giving them basic skills in grammar widening their vocabulary and teaching them to write simple and correct English.

1. **Comprehension and vocabulary**

A. Question based on content from the prescribed text 10

B. Question based on a passage from the prescribed text to test the candidate's comprehension and vocabulary 20

C. Question based on an unseen passage to test the candidate's comprehension and vocabulary 10

(there will be text of essays and short stories between 100 and 120 pages in length. The text book prescribed is " Language Through Literature" (OUP, NEW DELHI)

2. Composition

A. Letter/application writing 10 marks

B. Paragraph writing/ precis writing 10 marks

C. Report writing 10 marks

3. Translation

A. Elements of a sentence 2 marks

B. Transformation of sentence 6 marks

C. Modals 2 marks

D. Tense usage 2 marks

E. Determiners 2 marks

F. Common errors in English 2 marks

G Phrasal verbs 4 marks

Phrasal verbs

Break	:	Break away, Break down, Break off, Break up
Bring	:	Bring about, Bring in, Bring up, Bring down
Come	:	Come by, Come across, Come upon
Carry	:	Carry out, Carry on, Carry off, Carry over
Call	:	Call on, Call off, Call at
Get	:	Get Along, Get Away, Get By, Get Through, Get Over
Give	:	Give up, Give away, Give in
Hard	:	Hard up, Hard of hearing, Hard nut to crack, Hard to please
Look	:	look after, look in to, look forward to, look upto
Put	:	put out, put off, put up, put up with
Run	:	run after, run down, run over, run out of
Take	:	take after, take up, take to

Books recommended

1.	A.J. Thomson and A.V. Martinet	: A Practical English Grammar (Oxford Paper Back)
2.	S.Pit Corder	: Intermediate English Practice Book (Orient Longman)
3.	Bhaskaran and Hordburgh	: Strengthen Your English (OUP 1973)
4.	T.l.h. Smith – Pearce	: The English Errors Of Indian Students (OUP)
5.	I.K. Sharma and V.D. Singh	: A Practical Course of English (Ramesh Book Depot, Jaipur)

1. प्रारम्भिक हिन्दी

(ELEMENTARY HINDI)

(सामान्य हिन्दी के स्थान पर केवल अहिन्दी भाषी क्षेत्रों से आए हुए विद्यार्थियों के लिए)

उत्तीर्णांक: 36 अवधि 3 घण्टे पूर्णांक : 100

अंकों का विभाजन-

1. पुस्तकों पर आधारित	50 अंक
2. व्याकरण से संबंधित	20 अंक
3. रचना से संबंधित	
क. लोकोक्तियाँ तथा मुहावरे आदि	10 अंक
ख. पत्र लेखन अथवा निबंध	20 अंक

पाठ्यक्रम :

1. अध्ययनार्थ पाठ्य पुस्तकें : क. निबंध-संग्रह , ख. कहानी संग्रह
2. व्याकरण : शब्द विचार, वाक्य विन्यास, वाक्य खण्ड, पद-क्रम का ज्ञान तथा इसमें होने वाली सामान्य त्रुटियों का ज्ञान।
3. रचना :
   क. मुहावरों तथा लोकोक्तियों का प्रयोग, काव्य में समान दिखाने वाले शब्दों का अर्थ-भेद और उनका वाक्यों में प्रयोग
   ख. पत्र लेखन, अथवा सरल निबन्ध।

पाठ्य पुस्तकें :

क. निबन्ध संग्रह

सुगम हिन्दी गद्य (सम्पादक) सूरज भान, राजपाल एण्ड सन्स, दिल्ली

ख. गल्पदर्शिका 2, 7 एवं 8 पाठों को छोड़कर

सं. एम. एल. गर्ग एवं कमला भटनाकर, कालेज बुक डिपो, जयपुर

ग. व्याकरण एवं रचना-

सुबोध व्याकरण एवं रचना- सं. श्री व्यथित हृदय संशोधन कर्त्ता- डॉ. अम्बाप्रसाद सुमन, श्री राम मेहरा एण्ड कम्पनी, आगरा।

OR

HISTORY OF INDIAN CIVILISATION

(in lieu of compulsory subject of General Hindi and Foreign Students)

Scheme of Examination

Min. Pass Marks 36 Duration: 3 hrs M.M. 100

There will be following three parts in the question paper of this subject.

Part A **Marks – 20**

Note : Part A will contain 10 question in all. candidate are required to attempt all question in 20 words each. All questions carry equal marks.

Part B **Marks – 20**

Part B will contain 05 question having one internal choice. Candidate are required to attempt five questions 50 words each. All questions carry equal marks.

Part C **Marks – 60**

Part C will cantain 05 questions in all. Candidate are required to attempt 03 questions in 400 words each. All questions carry equal marks.

HISTORY OF INDIAN CIVILISATION

Part 'A'

Outline of Historical Development : Indus Valley and the Aryans. Rise of Territorial States, Rise of Empires-Mauryas, Gupta, Kushan & Vardhana.

Part B'

Emergence and Impact of Islam, the Rajput and Akbar. The British Impact. The National Movement Tilak, Gandhi and Nehru.

Part 'C'

Social Life and Cultural Heritage : Family, Caste, Education, Buddhism and Jainism, Bhakti Movement, Literary and Art Heritage. Epics, Kalidas. Tulsidas, Tagore, Sanchi Ajanta Temple Architeture, Mughal Architecture Rajput and Mughal Painting.

2. ELEMENTARY COMPUTER APPLICATIONS

Paper	Exam Hours	Marks Max	Marks Min
Theory	3	100	36

Theory Examination paper will be as follows:

Duration 3 hours, maximum marks 100, consisting of 100 objective type questions of 1 marks each.

Syllabus

1. Introduction to Information Technology, evolution and generation of computers, type of computers, micro, mini, mainframe and super computer. Architecture of a computer system: CPU, ALU, Memory (RAM, ROM families)

cache memory, input/output devices, pointing devices.

2. Number system (binary, octal, decimal and hexadecimal) and their inter-conversions, character codes (ASCII, EBCDIC and Unicode). Logic gates, Boolean Algebra, machine, assembly and high level language including 3GL and 4GL.
3. Concept of Operating system, need and types of operating systems, batch, single user, multi-processing, distributed and time-shared operating systems. Process and memory management concepts. Introduction to Unix, Linux, Windows, Windows NT systems and their simple commands.
4. Internet: Concepts, email services, world wide web, web browsers, search engines, simple programs in HTML, type of HTML documents, document structure element, type and character formation, tables, frames and forms.
5. Word processing packages, standard features like tool bar, word wrap, text formatting, paragraph formatting, effect to text, mail-merge.
6. Presentation Packages: Slide creation, slide shows, adding graphics, formatting, customizing and printing.
7. Computer Networking: Type of networks, LAN, MAN and WAN concept of technology, bridges and routers, gateways and modems, ISDN and leased lines, teleconferencing and videoconferencing.
8. Multimedia technology: Introduction, framework for multimedia devices, image compression standards, JPEG, MPEG and MIDI formats.
9. Database Management Systems: Data, field and records, information database, creation of a database file, insertion, deletion and updating of records, modifying structure, editing and browsing of records, searching, sorting and indexing of records, retrieving of records and report generation. Data processing in government organizations.
10. E-commerce: Concept of e-commerce, benefits and growth of e-commerce, security considerations and hazards of virus and other security risks, anti-virus software, electronic payment system.

Laboratory:

The laboratory exercises will be designed to help in the understanding of concepts of computer and the utilization in the areas outlined in the theory syllabus. The emphasis should be on practical usage rather than on theoretical concepts only. In addition, MS-Office package is to be practiced in the lab.

3.COMPULSORY PAPER OF ENVIRONMENTAL STUDIES

Compulsory in I year for all streams at undergraduate level

Scheme of examination

Time 3 hrs Pass Marks 36 Max. Marks 100

Theory

Theory paper will contain nine questions. The students are required to attempt five question in all including question no. 1 which will be compulsory.

Q1 short answer type. Ten question of two marks each (compulsory)

10×2 = 20 marks

Q2 to Q9 essay type question of 20 marks each (attempt any four)

The students are required to visit some field or sites mentioned in the syllabus under the guidance of a teacher. The teacher shall certify that the student have visited the site and should further inform their respective principal in writing regarding the same.

Note:

1. The marks secured in this paper shall not be counted in awarding the division to a candidate.
2. The candidate have to clear compulsory paper in three chances
3. Non appearing or absent in the examination of compulsory paper will be counted a chance.

CORE MODULE SYLLABUS FOR ENVIRONMENTAL STUDIES FOR UNDERGRADUATE COURSES OF ALL BRANCHES OF HIGHER EDUCATION

Unit 1: The Multidisciplinary nature of environmental studies

Definition, scope and importance

Need for public awareness.

Unit 2: Natural Resources:

Renewable and non-renewable resources:

- Natural resources and associated problems.

a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

b) Water resources: Use and over-utilization of surface and groundwater, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources. Case studies.

f) Land resources: Land as a resource, Land degradation, man induced Landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

Unit 3: Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Producers, consumers and decomposers.

- Energy flow in the ecosystem
- Ecological succession
- Food chains, food webs and ecological pyramids
- Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit 4: Biodiversity and its conservation

- Introduction – Definition: genetic, species and ecosystem diversity.
- Biogeographical classification of India
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values
- Biodiversity at global, National and local levels.
- India as a mega-diversity nation
- Hot-spots of biodiversity.
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit 5: Environmental Pollution

Definition

- Causes, effects and control measures of:-

a. Air pollution
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution
- Pollution case studies.
- Disaster management: floods, earthquake, cyclone and landslides.

Unit 6: Social Issues and the Environment

- From Unsustainable to Sustainable development
- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people; its problems and concerns. Case Studies.
- Environmental ethics: Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation.
- Consumerism and waste products.
- Environmental Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and Control of Pollution) Act.
- Wilde life Protection Act.
- Forest Conservation Act.
- Issues involved in enforcement of environmental legislation.
- Public Awareness.

Unit 7: Human Population and the Environment

- Population growth, variation among nations.
- Population explosion- Family Welfare Programme.
- Environment and Human health.
- Human Rights.
- Value Education.
- HIV/AIDS.
- Women and Child Welfare.
- Role of Information Technology in Environment and human health.
- Case Studies.

Unit 8: Field Work

- Visit to a local area to document environmental assets- river / forest / grasslands / hill/ mountain.
- Visit to local polluted site- Urban /Rural / Industrial /Agricultural.
- Study of common plants, insects, birds.
- Study of simple ecosystems- pond, river, hill slope, etc.

B.SC.(HONS.) PART-I CHEMISTRY-

Scheme of Examination for B.Sc. (Hons)Part-I Chemistry-

Paper No.	Paper Name	Max.Marks	Duration
I	Inorganic Chemistry	75	3 Hrs.
II	Organic Chemistry	75	3 Hrs.
III	Physical Chemistry	75	3 Hrs.
IV	Instrumental Methods of Analysis	75	3 Hrs.
V	Practicals	100	10 Hrs(Distributed over two days
	Grand Total	**400**	

PAPER – I INORGANIC CHEMISTRY

Duration 3 hrs. **Max. Marks : 75**

Note: Each theory paper is divided into three independent units. The question paper is divided into three parts Part -A, Part -B and Part –C. Part A (15 marks) is compulsory and contains 10 questions (20 words) at least three questions from each unit, each question is of 1.5 mark. Part –B (15 marks) is compulsory and contains five questions at least one from each unit. Candidate is required to attempt all five questions. Each question is of 3 marks (50 words). Part –C (45 marks) contains six questions two from each unit. Candidate is required to attempt three questions one from each Unit. Each question is of 15 marks (400 words).

Unit-I

A. Atomic Structure

Idea of de Brogile matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of ψ and ψ^2, quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s. p, d orbitals. Aufbau and Pauli exclusion principles, Hunds multiplicity rule. Electronic configuration of the elements, effective nuclear charge.

B. Chemical Bonding

Covalent Bond – Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion (VSEPR) theory to NH_3, $H3O^+$, SF_4, CIF_3, ICl_2, and H_2O, MO theory, homonuclear and heteronuclear (CO and NO) diatomic molecules, multicentre bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference. Comparison of valence bond and molecular orbital theories.

Unit-II

A. Periodic Properties

Atomic and ionic radii, ionization energy, electron affinity and electonegativity- definition, methods of determination and trends in periodic table, applications in predicting and explaining the chemical behaviour.

B. s-Block Elements

Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, and introduction to alklys and aryls.

C. p-Block Elements

Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides and halides of groups 13-16,

hydrides of boron-diborane and higher boranes, borazine, borohydrides. Carbides, silicons and their industrial applications. Oxyacids and halides of sulphur, peracids of sulphur oxides and oxy acids of halogens.

Unit-III

A. Ionic Solids-

Ionic structures, radius ratio and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule. Metallic bond- free electron, valence bond and band theories. Defects in crystal structures.

B. Weak Interactions- Hydrogen bonding, van der Waals forces.

C. Fullerenes, carbides, flurocarbons, silicates (Structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalides.

D. Chemistry of Noble Gases

Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

E Chemistry of organomellic compounds of Lithium, Zinc, Tin and Lead.

PAPER –II ORGANIC CHEMISTRY

Duration 3 hrs. **Max. Marks : 75**

Note: Each theory paper is divided into three independent units. The question paper is divided into three parts Part -A, Part -B and Part –C. Part A (15 marks) is compulsory and contains 10 questions (20 words) at least three questions from each unit, each question is of 1.5 mark. Part –B (15 marks) is compulsory and contains five questions at least one from each unit. Candidate is required to attempt all five questions. Each question is of 3 marks (50 words). Part –C (45 marks) contains six questions two from each unit. Candidate is required to attempt three questions one from each Unit. Each question is of 15 marks (400 words).

UNIT-I

A. Structure and Bonding

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, van der Waals interactions, inclusion compounds, clatherates, charge transfer complexes, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

B. 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 example). Assigning formal charges on intermediates and other ionic species.

Methods of determination of reaction mechanism (products analysis, intermediates, isotope effects, kinetic and stereochemical studies.)

C. Stereochemistry of Organic Compounds

Concept of isomerism. Types of isomerism. Optical isomerism-elements of symmetry, molecular chirality, enatiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of ennantiomers, inversion, retention and racemization.

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 formulae.

Difference between configuration and conformation.

UNIT-II

A. Alkanes and Cycloalkanes

IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atoms 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.

B.Alkenes

Nomenclature of alkenes, methods of formation, mechanism of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes-mechanisms 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.

C. Cycloalkenes, Dienes and Alkynes

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 reactions-1,2 and 1,4 additions, Diels-Alder reaction.

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-III

A. Arenes and aromaticity

Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain. Structure of benzene: molecular formula and Kekule structure. Stability and carbon- carbon bond lengths of benzene, resonance structure, MO picture.

Aromaticity: the Huckle rule, aromatic ions.

B. Aromatic electrophilic substitution- general pattern of the mechanism, role of σ and π Complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio, Side chain reactions of benzene derivatives. Birch reduction.

C. Methods of formation and chemical reactions of alkylbenzenes, alkynylbenzenes and biphenyl.

D. Alkyl and Aryl Halides

Nomenclature and classes of alkyl halides, Methods of formation, chemical reaction. Mechanisms of nucleophilic substitution reactions of alkyl halides, S_N2 and S_N1 reactions with energy profile diagrams.

Polyhalogen compounds: chloroform, carbon tetrachloride.

Methods of formation of aryl halides, nuclear and side chain reactions. The addition elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions.

Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides.

Synthesis and uses of DDT and BHC.

PAPER –III PHYSICAL CHEMISTRY

Duration 3 hrs. **Max. Marks : 75**

Note: Each theory paper is divided into three independent units. The question paper is divided into three parts Part -A, Part -B and Part –C. Part A (15 marks) is compulsory and contains 10 questions (20 words) at least three questions from each unit, each question is of 1.5 mark. Part –B (15 marks) is compulsory and contains five questions at least one from each unit. Candidate is required to attempt all five questions. Each question is of 3 marks (50 words). Part –C (45 marks) contains six questions two from each unit. Candidate is required to attempt three questions one from each Unit. Each question is of 15 marks (400 words).

UNIT-I

A. Mathematical Concepts and Computers

(a) Mathematical Concepts

Logarithmic relations, curve sketching, linear graphs and calculation of slopes, differentiation of functions like k_x, e^x, x^n, sin x, log x; maxima and minima, partial differentiation and reciprocity relations. Integration of some useful/ relevant functions; permutations and combinations. Factorials. Probability

(b) Computers

General introduction to computers, different components of a computer, hardware and software, input-output devices; binary numbers and arithmetic; introduction to computer language. Programming, operating systems.

B. Colloidal State

Definition of colloids, classification of colloids.

Solids in liquids (sols): properties- kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schulze law, gold number.

Liquids in liquids (emulsions); types of emulsions, preparation. Emulsifier.

Liquids in solids (gels): classification, preparation and properties, inhibition, general applications of colloids.

UNIT-II

A. Gaseous States

Postulates of kinetic theory of gases, deviation from ideal behavior, van der Waals equation of state.

Critical Phenomena:PV isotherms of real gases, continuity of states, the isotherms of van der Waals equation, relationship between critical constant and van der Waals constants, the law of corresponding states, reduced equation of state.

Molecular velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquification of gases (based on Joule-Thomson effect.)

B. Liquid State

Intermolecular forces, structure of liquids (a qualitative description)

Structural differences between solids, liquids and gases.

Liquids crystals: Difference between liquid crystal, solid and liquic Classification, structure of nematic and cholestric phases. Thermography an seven segment cell.

UNIT-III

A. Solid State

Definition of space lattice, unit cell.

Laws of crystallography-(i)Law of constancy of interfacial angles (ii) Lav of rationality of indices (iii) Law of symmetry. Symmetry elements in crystals.

X-ray diffraction by crystals. Derivation of Bragg equation. Determinatior of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method). Insulators, semi conductor and super conductors.

Catalysis, Characteristics of catalysed reactions, classification of catalysis, miscellaneous example, enzyme catalysis.

B. Solutions, Dilute Solutions and Colligative Properties

Ideal and non-ideal solutions, methods of expressing concentration of solutions, activity and activity coefficient.

Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression in freezing point. Experimental methods for determining various colligative properties.

Abnormal molar mass, degree of dissociation and association of solutes.

PAPER-IV INSTRUMENTAL METHODS OF ANALYSIS

Duration 3 hrs. **Max. Marks : 75**

Note: Each theory paper is divided into three independent units. The question paper is divided into three parts Part -A, Part -B and Part –C. Part A (15 marks) is compulsory and contains 10 questions (20 words) at least three questions from each unit, each question is of 1.5 mark. Part –B (15 marks) is compulsory and contains five questions at least one from each unit. Candidate is required to attempt all five questions. Each question is of 3 marks (50 words). Part –C (45 marks) contains six questions two from each unit. Candidate is required to attempt three questions one from each Unit. Each question is of 15 marks (400 words)

Unit-I

A. Atomic Absorption Spectrometry: Principle and instrumentation, application, determination of arsenic, cadmium and mercury in industrial waste, lead copper and iron in sewage effluents, boron in water, iron and magnesium in blood.

B. Flame photometry: Principle, instrumentation and applications.

C. Electrochemical Methods of Analysis: D.C. Polarography: Basic principle, types of currents, droping mercury electrodes, experimental technique, half wave potential, ilkovic equation (no derivation), cathodic wave equation, maxima and its suppression, application in qualitative and quantative analysis of alloys, mixtures and organic compounds. Normal pulse polarography.

Unit-II

A. High performance liquid chromatography (HPLC): Basic principle, mode of separation, instrumentation with particular reference to pumps, injectors, columns, detectors, integrators, recorders, comparison with GLC analytical applications.

B. Gas Liquid Chromatography: Introduction, choice of system, instrumentation applications qualitative and quantitative analysis.

C. Gel Permeation of Size Exclusion Chromatography: Introduction theory and application.

D. Ion Exchangers: Introduction, types cationic, anionic, chelating and liquid ion exchangers, preparation, action and properties of exchangers and application of ion exchangers.

E. Solvent Extraction: Introduction, principle, factors influencing solvent extraction, ion association complexes, application of solvent extraction.

F. Zone Electrophoresis: Introduction, factors affecting ionic migration, detection of separated component and applications of zone electrophoresis.

Unit-III

A.Thermogravimetry (TG) and Derivative Thermogravimetry (DTG): Principle, technique and instrumentation, types of balance, factors influencing TG curves, application to analysis and kinetics.

B. Differential Thermal Analysis(DTA): Principle, technique and instrumentation, factors influencing DTA curves, applications.

C. Differential Scanning Calorimetry ((DSC): Principle, technique and instrumentation, comparison with DTA, Factors, Influencing DSC curves and applications.

D. Radio Analytical Method of Analysis: **Law of radio active decay, detection of radiations, types of measuring instruments, principle of operation and uses, G.M. tubes and their characteristic, ionization chamber, proportional counters, scintillation counter, solid state detectors, calibration of counting equipments, determination of absolute disintegration rates.**

E. Active Analysis: Principle, various methods of activation methodology advantage, limitations and applications, isotopic dilution analysis and radio immunoassay analysis.

BOOKS RECOMMENDED:

(1) Fundamentals of Molecular Spectroscopy G.M. Banwell, McGraw Hill, N.Y. 1972.
(2) Introduction to Molecular Spectroscopy G.M. Barrow, Mc Graw Hill. N.Y.1972
(3) Spectroscopy and Molecular Structure G.W. king, Hold Richart and Winston, N.Y.1964.
(4) Molecular Structure and Dynamic W.H. Flygare, Prentice Hall,1978
(5) Spectroscopy, Vols, I & II walkerand H. Straw, Chapman and Hall 1962.
(6) Molecular SpectroscopyJ.D. GraybealMcGraw Hill 1988.
(7) Guide to Activation Analysis, W.S. Lyon Jr. D. Van Nostrand Company.
(8) Instrumental Methods of Chemical Analysis, G.W. Ewing McGraw Hill Book Company inc. 1975.
(9) Polarographic Technique by Miltes L. (Interscience Publishers.)
(10) Treatise on Analytical Chemistry, Part I Vol.5 Ed. I M. Kolthoff and Irving Interscience publishers,1964.
(10) Modern Methods of Chemical Analysis at R.L. Pecsokand L.D. Shields, johyWiley and Sons Inc.
(11) A Text Book ofQuantitative Inorganic Analysis, A.I. Vogel,longman.
(12) Analytical Chemistry S.M. Khopkar.
(13) Inorganic Thermogravimetric Analysis Duval.
(14) Thermal Analysis T. Danrels.
(15) Differential Analysis Mackenzie.
(16) Solvent Extraction in Analytical Chemistry, G.H. Morrision and Fresier John Wiley and Sons Inc.
(17) Exchange and Solvent Extraction. J.M. marinsky and Y. Parcus, Marcel and Dekkar.
(18) Ion Exchange and Separation in Analytical Chemistry, O. Samuelson, John Wiley and Sons Inc.
(19) Polarography by Kolthoff I.M. and Lingane.J. (Interscience publishers)

PAPER–V
PRACTICAL

Max.Marks:100 **Time :10 Hours**

Practicals

1. Inorganic Chemistry

Semimicro Analysis- separation and identification of six ions, cation

analysis from Groups I, II, III, IV, V and VI. anion analysis including interfering radicals.

2. Organic Chemistry

(A) Laboratory Techniques. (Any six)

(a) Calibration of Thermometer
80-82° (Naphthalene), 113.5°-114° (Acetanilide),
132.5-133° (urea), 100° (Distilled Water)

(b) Determination of Melting Point
(Naphthalene), 80-82°, Benzoic acid 121.5-122°
Urea 132.5-133°, Succinic acid 184.5-185°
Cinnamic acid 132.5-133°, Salicyclic acid 154.5-158°
Acetanilide 113.5-114° m-Diniitrobenzene 90°
p-Dichlorobenzene 52° Aspirin 135°

(c) Determination of boiling points
Ethanol 78°, Cyclohexane 81.4°, Tolune 110.6° Benzene 80°

(d) Mixed melting points
Urea-Cinnamic acid mixture of various compositions (1:4, 1:1, 4:1)

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

(f) Crystallization
Concept of induction of crystallization
Phthalic acid from hot water (using fluted filter paper and stemless funnel)
Acetanilide from boiling ethanol
Benzoic acid from water

(g) Decolorisation and crystallization using charcoal
Decolorisation of brown sugar (sucrose) with animal charcoal using gravity filtration. Crystallization and decolorisation of impure naphthalene (100 g of naphthalene mixed with 0.3 g if Congo Red using 1 g decolorising carbon) from ethanol.

(h) Sublimation (Simple and Vacuum)
Camphor, Naphthalene, Phthalic acid and Succinic Acid.

(B) Qualitative Analysis

Detection of extra elements (N,S and halogens) and functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide) in simple organic compounds.

(C) Quantitative Analysis: Separation of cations and anions by
(i) Paper Chromatography
(ii) Column Chromatography-Ion exchange

(iii) Isolation of caffeine from tea leaves.
(iv) Isolation of casein from milk (the students are required to try some typical colour reactions of proteins).
(v) Isolation of piperine from black pepper.

3. PHYSICAL CHEMISTRY (ANY FIVE)

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
3. To compare the strengths of HCI and H_2SO_4 by studying the kinetics of hydrolysis of ethyl acetate.
4. To study kinetically the reaction rate of decomposition of iodide by H_2O_2.
5. To study the distribution of iodine between water and CCI_4
6. To study the distribution of benzoic acid between benzene and water.
7. To prepare arsenious sulphide sol and compare the precipitating power of mono-,bi- and trivalent anions.
8. To determine the percentage composition of a given mixture (non interacting systems) by visocosity method.
9. To determine the viscosity of amyl alcohol in water at different concentrations and calculate the excess viscosity of these solutions.
10. To determine the percentage composition of a given binary mixture by surface tension method(acetone & ethyl methyl ketone).

Distribution of Marks **Max. Marks:100**

Inorganic
Semimicro Analysis- 30 (05 marks each for one ion)(No negative marking)

Organic

(A)	Three laboratories techniques	-	15
(B)	Qualitative Analysis		
	Two functional Groups	-	08
(C)	Qualitative Analysis		
	One experiment	-	07

Physical

One experiment is to be performed	-	25
Viva	-	10
Record	-	05

2. MATHEMATICS

SCHEME

Paper	Nomenclature	Teaching Hours/week	Examination Duration	Maximum Science
I	Algebra and Matrices	5	3 Hrs	80

II	Calculus	5	3 Hrs	80
III	Vector Calculus and Geometry	5	3 Hrs	80
IV	Spherical Astronomy	5	3 Hrs	80
V	Mathematical Statistics	5	3 Hrs	80
		Max Marks		400
		Min. pass Marks		160

PAPER I – ALGEBRA AND MATRICES

Duration:3Hrs. Max.Marks : 80

Note Each theory paper is divided into three independent units.

The question paper is divided into three parts Part-A, Part-B and Part-C.

Part A **(16 Marks)** is ***compulsory*** and contains 10 questions (20 words) at least 3 questions from each unit, each question is of 1.6 marks.

Part B **(16 Marks)** is ***compulsory*** and contains 5 questions (50 words) at least one question from each unit. All questions carry equal marks.

Part C **(48 Marks)** contains 6 questions two from each unit. Candidate is required to attempt 3 questions one from each Unit. Each question is of 16 marks (400 words).

UNIT - I (Matrices)

Hermitian and skew Hermitian matrices. Elementary Operations on matrices. Inverse of a matrix. Linear independence of row and column matrices. Row rank, column rank and rank of a matrix. Equivalence of column and row ranks. Eigen values, Eigen vectors and the characteristic equation of a matrix. Cayley- Hamilton theorem and its use in finding inverse of a matrix. Applications of matrices to solve a system of linear (both homogeneous and non homogeneous) equations. Theorems on consistency of a system of linear equations.

Relation between the roots and coefficients of general polynomial equation in one variable, Transformation of equations. Descarte's rule of signs. Solution of Cubic equations (Cardon method), Bi-quadratic equations.

UNIT - II (Group Theory)

Definition of a group with examples. Order of a finite group. General properties of groups. Integral powers of an element of a group. Order of an element of a group. Subgroups. Generation of groups.

Cyclic groups, Coset Decomposition, Lagrange's theorem and its consequences, Fermats and Euler's theorems.

UNIT - III

Normal subgroups and Quotient groups. Permutation, Permutation groups, Cyclic permutations, Even and odd permutations. The alternating group A_n, Cayley's theorem. Morphism of Groups, Homomorphism and Isomorphism, The fundamental theorem of homomorphism.

PAPER II - CALCULUS

Duration:3 Hrs. Max.Marks : 80

Note Each theory paper is divided into three independent units.

The question paper is divided into three parts Part-A, Part-B and Part-C.

Part A **(16 Marks)** is ***compulsory*** and contains 10 questions (20 words) at least 3 questions from each unit, each question is of 1.6 marks.

Part B **(16 Marks)** is ***compulsory*** and contains 5 questions (50 words) at least one question from each unit. All questions carry equal marks.

Part C **(48 Marks)** contains 6 questions two from each unit. Candidate is required to attempt 3 questions one from each Unit. Each question is of 16 marks (400 words).

UNIT - I (Differential Calculus)

Derivative of the length of an arc, Curvature, various formulae, Centre of curvature, Chord of curvature and related problems, Asymptotes.

Concavity and convexity. Singular point, Double point. Curve tracing (in cartesian and polar co-ordinates.)

UNIT - II (Integral Calculus)

Quadrature, Rectification, Intrinsic equation, Volume and Surfaces of solids of revolution.

UNIT - III (Ordinary Differential Equations)

Concept and formation of a Differential Eauation, Order and Degree of a Differential equation, Equations of first order and first degree, Equation in which the variables are separable, Linear differential equations, Bernoulle's equation, Homogeneous equations, Linear equations and Equations reducible to the linear form. Exact differential equations, Differential equations of first order and higher degree; solvable for x, y, p, Clairaut's form, Singular solutions.

Geometrical meaning of a differential equation, Orthogonal trajectories, Linear differential equations with constant coefficients, Ordinary

homogeneous linear differential equations.

PAPER III - VECTOR CALCULUS AND GEOMETRY

Duration:3Hrs. Max.Marks : 80

Note Each theory paper is divided into three independent units.

The question paper is divided into three parts Part-A, Part-B and Part-C.

Part A **(16 Marks)** is ***compulsory*** and contains 10 questions (20 words) at least 3 questions from each unit, each question is of 1.6 marks.

Part B **(16 Marks)** is ***compulsory*** and contains 5 questions (50 words) at least one question from each unit. All questions carry equal marks.

Part C **(48 Marks)** contains 6 questions two from each unit, Candidate is required to attempt 3 questions one from each Unit. Each question is of 16 marks (400 words).

UNIT - I (Vector Calculus)

Vector differentiation , Gradient, Divergence and Curl . Identities involving these operators and related problems.

Vector Integration, Line and surface integral, Theorems of Gauss, Green's and Stoke's and problems based on these theorems.

UNIT - II (Geometry)

General equation of second degree. Tracing of conics, Centre of a conic, Co-ordinates of the centre. Equation of the conic referred to centre as origin, Asymptotes of a conic. Lengths and position of axes of a standard conic. Eccentricity , Foci, Directrices, Axis, Latus rectum of a conic, Vertex and focus of the parabola, Tracing of Ellipse and Hyperbola.

The polar equation of a conic : Polar co-ordinates , Polar equation of a straight line , circle and conic.Focal chord, Auxilary circle. Tracing of conic $l/r = 1 + e\cos\theta$ .Tangents, Asymptotes, perpendicular lines, Normal, Polar to a conic.

Sphere, Plane section of a sphere, Tangent plane, Pole and Polar Plane, Orthogonal spheres, Radical plane, Radical Centre,

UNIT - III

Cone, Reciprocal cone, Right circular cone, Enveloping cone, Cylinder Right circular cylinder, Enveloping cylinder.

Central conicoids: Ellipsoid, Tangent plane, Polar, Polar lines, Enveloping cone, Enveloping cylinder, Section with a given centre, Normals,

Conjugate diameters and Diametral planes and their properties. General equation of second degree in three dimensions.Intersection of a line and a conicoid.Tangent lines and tangent plane. Condition of tangency. Plane section with a given centre. Diametral plane.Principal planes and Principal directions. Paraboloids, Plane sections of central conicoids, Umbilics.

PAPER IV - SPHERICALASTRONOMY

Duration:3Hrs. Max.Marks : 80

Note Each theory paper is divided into three independent units.

The question paper is divided into three parts Part-A, Part-B and Part-C.

Part A **(16 Marks)** is ***compulsory*** and contains 10 questions (20 words) at least 3 questions from each unit, each question is of 1.6 marks.

Part B **(16 Marks)** is ***compulsory*** and contains 5 questions (50 words) at least one question from each unit. All questions carry equal marks.

Part C **(48 Marks)** contains 6 questions two from each unit. Candidate is required to attempt 3 questions one from each Unit. Each question is of 16 marks (400 words).

UNIT - I

Spherical Trignometry :Spherical triangle, Length of a small circular arc. Terrestrial Latitude and Longitude, Different formulae, Right angled and quadrantal triangles, Polar Formulae , Trigonometrical ratios for small angles.

The Celestial Sphere: Altitude and Azimuth. Declination and Hour angle, Circumpolar Stars, Standard Celestial Sphere, Right ascension and declination, Celestial Latitude and Longitude, Sidereal time, Mean solar time, Hour angle of a heavenly body , Rising and Setting, Rate of change of Zenith distance and Azimuth .Twilight.

UNIT - II

Refraction: Laws of refraction. Refraction for small Zenith distances.General formula for refraction, The effect of refraction on the time of Sunset. Effert of refraction on the Right Ascension and Declination of a star.

The Meridian Circle: General description, Instrumental errors. Azimuth errors ,level error, collimation error. Total correction, Bessel,'s Formula.

Planetary motion: Kepler's laws, Newton's law of gravitation. Masses of the planets, Perturbations of the elements. The true and eccentric anomalies and their relations Kepler's equation, solutions of Kepler's equation

Time:Sideral time , Ephemeris and Universal time, The Sidereal year and the Tropical year. Relation between universal and mean sideral time. The calendar, equation of time, seasons, Time of the sun's transit over any meridian .Time of the moon's transit over any meridian

UNIT - III

Abberration:The law of aberration, Annual aberration of ecliptic, Longitude and Latitude . The aberrational ellipse. Aberration in Right Ascension and Declination.The elliptic motion of the earth and aberration. Measurement of the constant of aberration . The theoritical value of aberrational constant. Diurnal aberration, Correction for light –time.

Precession and Nutation: Effect of precession on the Right Ascension and Declaration of a star. Alternative method. Nutation, Nutation in the obliquity, Planetary precession. The mean equator and the mean co-ordinate of a star. The true equator and the true co-ordinates of a star. The apparent place of a star, Reduction from mean place to apparent place (Vice Versa). Eclipses:Eclipses of the moon, The ecliptic limits calculation of a lunar eclipse, Eclipses of the sun.

PAPER V - MATHEMATICAL STATISTICS

Duration:3Hrs. Max.Marks: 80

Note Each theory paper is divided into three independent units.

The question paper is divided into three parts Part-A, Part-B and Part-C.

Part A **(16 Marks)** is ***compulsory*** and contains 10 questions (20 words) at least 3 questions from each unit, each question is of 1.6 marks.

Part B **(16 Marks)** is ***compulsory*** and contains 5 questions (50 words) at least one question from each unit. All questions carry equal marks.

Part C **(48 Marks)** contains 6 questions two from each unit. Candidate is required to attempt 3 questions one from each Unit. Each question is of 16 marks (400 words).

UNIT - I

Probability:Law of total and compound probability, Conditional probability, Bay`s theorem, Mathematical expectations , Moments.

Moment generating functions , Cumulants and Cumulant generating functions,Measures of skewness and kurtosis.

UNIT - II

Univariat probability distribution Binomial and Poision distributions.Fitting of Binomial and Poision distribution. Rectangular distribution with important properties.

UNIT - III

Normal distribution and its properties

The principle of least squares and curve fitting, Bivarite distribution,Correlation and regression .Multiple and Partial Correlation.

SCHEME B.SC. (HONS) PART-II EXAMINATION-

CHEMISTRY

Papers	Hours/ week	Max. Marks	Min. Pass Marks	Duration
Paper- I - Inorganic Chemistry	3	75		3Hrs
Paper- II - Organic Chemistry	3	75	120	3Hrs
Paper-III- Physical Chemistry	3	75		3Hrs
Paper-IV- Environmental Chemistry	3	75		3Hrs
Paper-V Practicals	6	100	40	10Hrs.

(Distributed in Two Days)

Note: Each theory paper is divided into three independent units. The question paper is divided into three parts Part -A, Part -B and Part –C. Part A (15 marks) is compulsory and contains 10 questions (20 words) at least three questions from each unit, each question is of 1.5 mark. Part –B (15 marks) is compulsory and contains five questions at least one from each unit. Candidate is required to attempt all five questions. Each question is of 3 marks (50 words). Part –C (45 marks) contains six questions two from each unit. Candidate is required to attempt three questions one from each Unit. Each question is of 15 marks (400 words).

PAPER I INORGANIC CHEMISTRY

Time:3 Hours **Max. Marks:75**

Unit I

A. Chemistry of Elements of First Transition Series

Characteristic properties of d-block elements.

Properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry.

B. Metal Ligand Bonding

Limitation of crystal field theory, molecular orbital theory, octahedral, tetrahedral and square planar complexes, π-bonding and molecular orbital theory.

C. Chemistry of Elements of Second and Third Transition series

General characteristics, comparative treatment with their 3d-analogues in

respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry.

Unit II

A. Metal π-Complexes: Metal carbonyls, structure and bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation, important reactions of metal carbonyls, preparation, bonding, structure and important reactions of transition metal nitrosyl.

B. Coordination Compounds

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.

D. Chemistry of Lanthanide Elements

Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds.

E. Chemistry of Actinides

General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the later actinides and the later lanthanides.

Unit III

A. Oxidation and Reduction

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

B. Acids and Bases

Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases.

C. Non-aqueous Solvents

Physical properties of a solvent, types of solvents and their general characteristics reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2

PAPER II ORGANIC CHEMISTRY

Time:3 Hours **Max. Marks:75**

Unit I

A. Electromagnetic Spectrum: Absorption Spectra

Ultraviolet (UV) absorption spectroscopy- absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathchromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones. Infrared (IR) absorption spectroscopy-molecular vibrations, Hooke's law, selection rules, intensity and position

of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorption of various functional groups and interpretation of IR spectra of simple organic compounds.

B. Ethers and Epoxides

Nomenclature of ethers and methods of their formation, physical properties. Chemical reactions- cleavage and autoxidation, Ziesel's method.

Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

Unit II

A. Alcohols

Classification and nomenclature.

Monohydric alcohols-nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols.

Dihydric alcohols-nomenclature, methods of formation ,chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HIO_4] and pinacol-pinacolone rearrangement.

Trihydric alcohols- nomenclature and methods of formation, chemical reactions of glycerol.

B. Phenols

Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols-electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben-Hooesch reaction, Lederer-Manasse reaction and Reimeer-Tiemann reaction.

C. Carboxylic Acids

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation.

Methods of formation and chemical reactions of halo acids.Hydroxy acids: malic, tartric and citric acids.

Methods of formation and chemical reactions of unsaturated monocarboxylic acids.

Dicarboxylic acids: methods of formation and effect of heat and dehydrating agents.

D. Carboxylic Acid Derivatives

Structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides. Relative stability of acyl derivatives. Physical properties,

inter conversion of acid derivatives by nucleophilic acyl substituion.

Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms of esterification and hydrolysis (acidic and basic).

Unit III

A. Aldehydes and Ketones

Nomenclature and structure of carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acid. Physical properties.

Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Witting reaction. Mannich reaction.

Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-villiger oxidation of ketones, Cannizzaro reaction. MPV, Clemmensen, Wolff-kishner, $LiAlH_4$ and $NaBH_4$ reductions, Halogenation of enolizable ketones.

An introduction to α,β unsaturated aldehydes and ketones.

B. Nucleic Acids: Purine and pyrimidine bases of nucleic acids, base pairing via H-bonding. Structure of ribonoucleic acids (RNA) and deoxyribonucleic acids (DNA), double helix model of DNA and force responsible for holding it.

C. Organic Compounds of Nitrogen

Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes.

Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media. Picric acid. Halonitroarenes: reactivity. Structure and nomenclature of amines, physical properties.Stereochemistry of amines. Separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts. Preparation of alkyl and aryl amines(reduction of nitro compounds, nitriles),reductive amination of aldehydic and ketonic compounds. Gabriel-phthalimide reaction, Hofmann bromamide reaction.

Reaction of amines, electrophilic aromatic substitution in aryl amines, reaction of amines with nitrous acid. Synthetic transformation of aryl diazonium salts, azo coupling.

D. Enzymes: Introduction and historical perspective, chemical and biological catalysis, remarkable properties of enzymes like catalytic power, specificity and regulation. Nomenclature and classification, extraction and purification.

PAPER III PHYSICAL CHEMISTRY

Time:3 Hours **Max. Marks:75**

Unit I

A. Thermodynamics - I

Definition of thern odynamic terms: system, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work.

First Law of Thermodynamics: Statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law-Joule-Thomson coefficient and inversion temperature. Calculation of w,q, dU, & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

Thermochemistry: standard state, standard enthalpy of formation-Hess's Law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy, Kirchhoff's equation.

B. Thermodynamics - II

Second law of thermodynamics: need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature.

Concept of entropy: entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

Third law of thermodynamics: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G with A with P, V and T.

C. Partition Function –Translation, rotational, vibrational and electronic partition functions, calculation of thermodynamic properties in terms of partition functions. Applications of partition functions.

Unit II

A. Chemical Equilibrium

Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Le Chatelier's principle.

Reaction isotherm and reaction isochore- Clapeyron equation and Clausisus- Clapeyron equation, applications.

B.Phase Equilibrium

Statement and meaning of the terms- phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system- water, CO_2 and S systems.

Phase equilibria of two component system- solid-liquid equilibria, simple eutectic-Bi-Cd, Pb-Ag systems, desilverisation of lead.

Solid solutions- compound formation with congruent melting point (Mg-

Zn) and incongruent melting point, ($NaCl-H_2O$), ($FeCl_3-H_2O$) and $CuSO_4-H_2O$)system. Freezing mixtures, acetone-dry ice.

Liquid-liquid mixtures- ideal liquid mixtures, Raoult's and Henry's law. Non-ideal system-azeotropes- $HCl-H_2O$ and ethanol – water systems. Partially miscible liquids- Phenol-water, trimethylamine, nicotine-water systems.

Lower and upper consolute temperature. Effect of impurity on consolute temperature.

Immiscible liquids, steam distillation.

Nernst distribution law-thermodynamic derivation, applications.

Phase equilbria of three component systems-liquid-liquid equilbria.

Unit III

A. Electrochemistry-I

Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution.

Migration of ions and Kohlrausch law, Arrehenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law its uses and limitations.

Debye-Huckel-Onsagar's equation for strong electrolytes (elementary treatment only).

Transport number, definition and determination by Hittorf method and moving boundary method.

Applications of conductivity measurements: determination of degree of dissociation, determination of K_a of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

B. Electrochemistry-II

Types of reversible electrodes-gas-metal ion, metal-insoluble salt anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode- reference electrodes-standard electrode potential, sign conventions, electrochemical series and its significance.

Electrolytic and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells.

EMF of a cell and its measurements. Computation of cell EMF. Calculation of thermodynamic quantities of cell reactions(ΔG, ΔH, and K), polarization, over potential and hydrogen over voltage.

Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.

Definition of pH and pK_a, determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods.

Buffers-mechanism of buffer action, Henderson-Hazel equation. Hydrolysis of salts.

Corrosion-types, theories and methods of combating it.

Theory of Indicators.

PAPER IV ENVIRONMENTAL CHEMISTRY

Time:3 Hours **Max. Marks:75**

Unit I

A. Air Pollutants and Control: Definition & sources of air pollution, air quality standards, classification of air pollutants, effects and control of CO, SO_2, NO_2 hydrocarbons, particulate matter, aerosols and automobile, exhaust air pollution.

B. Air Analysis: Criteria for sample selection, techniques used for air sampling and methods for analysis for the determination of CO, NO_2, SO_2, HC & particulate.

Unit II

A. Water Pollutants and Control: Sources of water, physico-chemical characteristics of water, drinking water, quality standards, sources effect & control of water pollution and major pollutants-sewage, fertilizers, detergents, pesticides, heavy metal, oil & petroleum products, radioactive substances, disinfectants, nitrogen compounds NO_3, NO_2 & nitrosamines.

B. Water Analysis: Methods for sampling of water, standard methods for water and waste water analysis.

Unit III

A. Soil Chemistry, pollutants & Analysis: Soil profile chemical and physical, concept and source of cation exchange capacity in soils, water soluble salts in saline and alkaline soils, fertility management of soils, soil pollution sources- waste, sludge, heavy metals, effects of pollutants on plant growth. Determination of organic carbon, organic matter, pH, electrical conductivity and total soil constituents.

B. Chemical Toxicology: Toxic chemical in the environment. Biochemical effects of As,Cd, Pb,Hg,Carbon monoxide, Sulphur dioxide, Nitrogen Oxide, Ozone, Cynide and Pesticides.

Books Recommended:

1. Essential Environmental Science Methods & Techniques, Simon Wassls and B. Halliwell, T.R. Publication Private Ltd. Chennai,1996.
2. The Comprehensive Hand Book of Hazardous Materials Regulations Handling, Monitoring and safety, Lewis Publishers, Boca Raton,1994.
3. Hazardous Air Pollutants, Howard J. Beim, Jennifer Spew, Louis Theodou, Van Nostrand Reinhold,1998.
4. Water Pollution, Conversion and Management, A.K. Sinha, Ram Boojh and P.N. Vishwanathan, Gyanodaya Prakashan, Nainital 1989.
5. Environmental Chemistry- A.K. De. John Wiley.

PAPER V : PRACTICALS.

Time: 10 Hours **Max. Marks:100**

Inorganic Chemistry

(A) Calibration of fractional weights, pipettes and burettes. Preparation of standard solutions. Dilution 0.1 M to 0.001 M solutions.

(B) Quantitative Analysis

Volumetric Analysis (Any Four)

(i) Determination of acetic acid in commercial vinegar using NaOH.
(ii) Determination of alkali content-antacid tablet using HCl.
(iii) Estimation of calcium content in chalk as calcium oxalate by permanganometry.
(iv) Estimation of hardness of water by EDTA.
(v) Estimation of ferrous and ferric dichromate method.
(vi) Estimation of copper using thiosulphate.

(B) Gravimetric Analysis.

(i) Analysis of Cu as CuSCN
(ii) Ni as Ni-dimethylglyoxime.

(C) Preparations (any four)

(i) $VO(acac)_2$
(ii) $Mn(acac)_3$
(iii) $K_3[Fe(C_2O_4)_3]$
(iv) Prussian Blue, Turnbull's Blue
(v) $Hg[Co(SCN)_4]$
(vi) $[Ni(dmg)_2]$
(vii) $[Ni(NH_3)_6]Cl_2$

Organic Chemistry

(A) Chromatography (Any Four)

(i) Separation , R_f values and identification of organic compounds.
(ii) Preparation and separation of 2,4-dinitrophenylhydrozone of acetone,2-butanone,hexan-2- and 3-one using toluene and light petroleum (40:60).
(iii) Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5)
(iv) Separation of a mixture of phenylalanine and glycine. Alanine and aspartic acid. Leucine and glutamic acid. Spray reagent-ninhydrin.
(v) Separation of a mixture of D,L- alanine, glycine and L-Leucine using n-butanol:acetic acid: water(4:1:5), spray reagent-ninhydrin.
(vi) Separation of monosachharides- a mixture of D-galactose and D-frutose using n-butanol:acetone : water (4:5:1) spray reagent-aniline hydrogen phthalate.

(B) Qualitative Analysis

Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives.

(C) Quantitative Analysis

(i) Determination of iodine, saponication values of an oil sample.
(ii) Determination of COD and BOD of water sample.

Physical Chemistry (Any Seven)

1. Determination of the transition temperature of the given substance by thermometric/dialometric method (e.g.$MnCl_2,4H_2O$,$SrBr_2$ $2H_2O$)
2. To study the effect of a solute(e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that solute in the given phenol-water system.
3. To construct the phase diagram of two component (e.g. diphenylamine-benzophenone) system by cooling curve method.
4. To determine the solubility of benzoic acid at different temperatures and to determineΔH of the dissolution process.
5. To determine the enthalpy of neutralisation of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.
6. To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.
7. Determination of the velocity constant, order of the reaction and energy of activation for saponification of ethyl acetate by sodium hydroxide conductometrically.
8. Determination of the strength of strong and weak acids in a given mixture conductometrically.
9. Determination of the strength of strong and weak acids in a given mixture using a potentiometer/pH meter.
10. Determination of rate constant for hydrolysis/inversion of sugar using a polarimeter.

Scheme of Examination (B.Sc. Hons. Pt. II) Max .Marks 100

Inorganic		
(A) Calibration & Preparation of solution	-	05
(B) Volumetric Analysis(one)	-	10
(C) Gravimetric Analysis (one)	-	10
(D) Preparation (one)	-	10
Organic		
(A) Chromatography (one exercise)	-	10
(B) Quantitative Analysis(one compound)	-	10
(C) Quantitative Analysis(one exercise)	-	10
Physical		
One experiment is to be performed	-	20
Record	-	05
Viva	-	10

MATHEMATICS

SCHEME

Paper	Nomenclature	Teaching Hours/week	Examination Duration	Maximum Science
I	Advanced Calculus	5	3 Hrs.	80
II	Differential Equations	5	3 Hrs.	80
III	Mechanics	5	3 Hrs.	80
IV	Discrete Mathematics	5	3 Hrs.	80
V	Operations Research	5	3 Hrs.	80
	Max Marks			400
	Min. pass Marks			180

PAPER I - ADVANCED CALCULUS

Duration:3Hrs. **Max.Marks : 80**

Note 1. Common paper will be set for both the faculties of Social sciences and Science. However the marks obtained by candidates in the faculty of Social sciences will be converted according to the ratio of the maximum marks of the paper in two faculties .

Note 2. Each theory paper is divided into three independent units.

The question paper is divided into three parts Part-A, Part-B and Part-C.

Part A **(16 Marks)** is ***compulsory*** and contains 10 questions (20 words) at least 3 questions from each unit, each question is of 1.6 marks.

Part B **(16 Marks)** is ***compulsory*** and contains 5 questions (50 words) at least one question from each unit. All questions carry equal marks.

Part C **(48 Marks)** contains 6 questions two from each unit. Candidate is required to attempt 3 questions one from each Unit. Each question is of 16 marks (400 words).

UNIT - I (Advanced Differential Calculus)

$\varepsilon - \delta$ definition of the limit of a function, Basic properties of limits, Continous functions and classification of discontinuities, Sequential Continuity, properties of continuous functions defined on closed intervals, Limit and Continuity of functions of two variables, Partial Differentiation, Change of variables, Euler's theorem on homogeneous functions, Jacobians. Differentiability, Chain rule of differentiability. Mean Value Theorems and their geometrical interpretation, Darboux's intermediate value theorem foı derivatives, Taylor's theorem for functions of two variables, Envelopes, Evolutes, Maxima, minima and saddle points of functions of two variables, Lagrange's multiplier method.

UNIT - II (Advanced Integral Calculus)

Beta and Gamma functions, Double and Triple integrals, Dirichlet's integrals, Change of order of integration in double integrals. Riemann integral, Integrability of continuous and monotonic functions. Darboux theorem, Fundamental theorem of integral calculus, Mean value theorems of integral calculus.

UNIT - III

Definition of a sequence, Theorems on limits of sequences, Bounded and monotonic sequences, Cauchy's convergence criterion, Infinite series of non-negative terms, its convergence, Different tests of convergence of infinite series *i.e.* comparison tests, Cauchy's integral tests, Ratio tests, Raabe's logarithmic, deMorgan and Bertrand's tests, Alternating series, Leibnitz's theorem, Absolute and conditional convergence.

Fourier series, Fourier expansion of piecewise monotonic functions, Uniform convergence of series of functions, Wirestrass M-test, Abel's test and Dirichlet's test.

PAPER II - DIFFERENTIAL EQUATIONS

Duration:3Hrs. **Max.Marks : 80**

Note 1. Common paper will be set for both the faculties of Social sciences and Science. However the marks obtained by candidates in the faculty of Social sciences will be converted according to the ratio of the maximum marks of the paper in two faculties .

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Part B **(16 Marks)** is ***compulsory*** and contains 5 questions (50 words) at least one question from each unit. All questions carry equal marks.

Part C **(48 Marks)** contains 6 questions two from each unit. Candidate is required to attempt 3 questions one from each Unit. Each question is of 16 marks (400 words).

UNIT - I (Ordinary Differential Equations)

Linear differential equations of second order, Normal Form, Transformation of the equations by changing the dependent / independent variable. Method of variation of parameters, Ordinary Simultaneous differential equations.

Total differential equations, Exact differential equations of *n*th order.

UNIT - II

Series solution of differential equations, Power series method, Bessel, Legendre and Hypergeometric equations, Bessel, Legendre and Hypergeometric functions and their properties. Laplace transformation, Properties and Laplace transformation of some standard functions. Laplace transform of the derivative, Inverse Laplace transformation and its applications in solving differential equations.

UNIT - III (Partial Differential Equations)

Partial differential equations of the first order, Lagrange's solution, Some special type of equations which can be solved easily by methods other than the general method, Charpit's general method of solutions.

Partial differential equations of second and higher orders, Classification of linear Partial differential equations of second order, Homogeneous and Non-homogeneous equations with constant coefficients.

PAPER III - MECHANICS

Duration:3Hrs. **Max.Marks : 80**

Note 1. Common paper will be set for both the faculties of Social sciences and Science. However the marks obtained by candidates in the faculty of Social sciences will be converted according to the ratio of the maximum marks of the paper in two faculties .

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The question paper is divided into three parts Part-A, Part-B and Part-C.

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Part B **(16 Marks)** is ***compulsory*** and contains 5 questions (50 words) at least one question from each unit. All questions carry equal marks.

Part C **(48 Marks)** contains 6 questions two from each unit. Candidate is required to attempt 3 questions one from each Unit. Each question is of 16 marks (400 words).

UNIT - I (Statics)

Analytical conditions of equlibrium of coplanar forces, Friction, Virtual work.

Common Catenary , Forces in three dimensions, Poinsot's central axis, Stable and unstable equilibrium.

UNIT - II (Dynamics)

Velocities and Accelerations along radial and transverse directions, and along tangential and normal directions, Simple Harmonic Motion, Rectilinear motion under variable laws.

Hook's law, related problems on horizontal and vertical elastic string , Motion in resisting medium.

UNIT - III

Constrained motion on smooth plane curves (Circular and Cycloidal Motion).

Impact (Direct and Oblique). Central orbits, $p - r$ equation, Apses, Time in an orbit, Kepler's laws of planetary motion.

PAPER IV - DISCRETE MATHEMATICS

Duration:3Hrs. **Max.Marks : 80**

Note 1. Common paper will be set for both the faculties of Social sciences and Science. However the marks obtained by candidates in the faculty of Social sciences will be converted according to the ratio of the maximum marks of the paper in two faculties .

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The question paper is divided into three parts Part-A, Part-B and Part-C.

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Part C **(48 Marks)** contains 6 questions two from each unit. Candidate is required to attempt 3 questions one from each Unit. Each question is of 16 marks (400 words).

UNIT - I

Sets Relations and Functions: Binary Relations, Equivalence Relations and Partitions. Partial Order Relations and Lattices. Chains and Antichains. Pigeon Hole Principle. Principle of Inclusion and exclusion.

Computability and Formal Languages: Ordered Sets, Languages .

Phase Structure Grammars. Types of Grammars and Languages.

UNIT - II

Permutations. Combinations and Discrete Probability.

Graphs and Planar Graphs: Basic Terminology. Multigraphs, Weighted Graphs. Paths and Circuits. Travelling Sales person problem, plannar Graphs, Trees.

UNIT - III

Finite State Machines : Equivalent Machines, Finite State Machine as Language Recognizers, Computable functions.

Boolean Algebras: Lattices and Algebraic Stractures, Duality, Distributive and Complemented Lattices. Boolean Lattices and Boolean Algebras. Boolean Functions and Expressions.

Propositional Calculus. Design and Implementation of Digital Networks. Switching Circuits.

PAPER V - OPERATIONS RESEARCH

Duration:3Hrs. **Max.Marks : 80**

Note 1. Common paper will be set for both the faculties of Social sciences and Science. However the marks obtained by candidates in the faculty of Social sciences will be converted according to the ratio of the maximum marks of the paper in two faculties .

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Part B **(16 Marks)** is ***compulsory*** and contains 5 questions (50 words) at least one question from each unit. All questions carry equal marks.

Part C **(48 Marks)** contains 6 questions two from each unit. Candidate is required to attempt 3 questions one from each Unit. Each question is of 16 marks (400 words).

UNIT - I

Linear independence, Linear dependence, Basis, Dimensions, Convex set and its properties.The Simplex alogorithm and its application to simple linear programming problems. Big-M method, Two phase method.

Concepts of Duality in linear programming, Formation of Dual problems, Elementary theorems of Duality.

UNIT - II

Degenarcy.Revised simplex Method.Generalised Simplex method. Assignment problems, Transportation problems, Post man Problem.

Game theory: Two Persons zero sum game, The maximum and minimum principle, Game without saddle points, Mixed strategies, Graphical solution of 2 x n and m x 2 games, Dominance property, Reduction of the game problem to L.P.P. Fundamental theorem of games.

UNIT - III

Inventory models, Deterministic and Stochastic models.

Queue theory :Queuing system and characteristic, Poison process and Exponential distribution, Classification of queues and steady states, M/M/I and M/M/C queuing systems and their simple models.

B.SC. (HONS) PART- III EXAMINATION

CHEMISTRY

Papers	Hours/ week	Max. Marks	Min. Pass Marks	Duration
Paper- I - Inorganic Chemistry	3	75		3Hrs
Paper- II - Organic Chemistry	3	75	120	3Hrs
Paper-III- Physical Chemistry	3	75		3Hrs
Paper-IV- Industrial Chemistry	3	75		3Hrs
Paper-V Practicals	6	100	40	10Hrs.

(Distributed over Two Days)

Note: Each theory paper is divided into three independent units. The question paper is divided into three parts Part -A, Part -B and Part –C. Part A (15 marks) is compulsory and contains 10 questions (20 words) at least three questions from each unit, each question is of 1.5 mark. Part –B (15 marks) is compulsory and contains five questions at least one from each unit. Candidate is required to attempt all five questions. Each question is of 3 marks (50 words). Part –C (45 marks) contains six questions two from each unit. Candidate is required to attempt three questions one from each Unit. Each question is of 15 marks (400 words).

PAPER-I INORGANIC CHEMISTRY

Time : 3 Hours **Max. Marks:75**

Unit-I

A. Metal-ligand Bonding in Transition Metal Complexes

Limitations of valence bond theory, an elementary idea of crystal-field theory, crystal field splitting in octahedral , tetrahedral and square planar complexes, factors affecting the crystal-field parameters.

B. Thermodynamic and Kinetic Aspect of Metal Complexes

A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes.

C. Magnetic Properties of Transition Metal Complexes

Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of μ_s and μ_{eff} values, orbital contribution to magnetic moments, application of magnetic moment data for 3d-metal complexes.

Unit-II

A. Electron Spectra of Transition Metal Complexes

Types of electronic transition, selection rules of d-d transitions, spectroscopic ground state, spectrochemical series. Orgel-energy level diagram for d^1 and d^9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion.

B. Organometallic Chemistry

Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyls and aryls of Li, Al, Hg, Sn and Ti, a brief account of metal-ethylenic complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.

Unit-III

A. Bioinorganic Chemistry

Essential and trace elements in biological processes, metallporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca^{2+}. Nitrogen fixation.

B. 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. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.

C. Silicones and Phosphazenes

Silicones and phosphazenes as examples of organic polymers, nature of bonding in triphosphazenes.

PAPER-II ORGANIC CHEMISTRY

Time : 3 Hours **Max. Marks:75**

UNIT-I

A. Spectroscopy

Nuclear Magnetic resonance (NMR) spectroscopy.

Proton magnetic resonance(^{1}H NMR) spectroscopy, nuclear shielding and dieshielding chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2,-tribromoethane, ethyl acetate, toluene and acetophenone. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.

B. Organometallic Compounds

Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reaction.

Organozinc compounds: formation and chemical reactions.

Organolithium compounds: formation and chemical reactions.

UNIT-II

A. Organic Synthesis via Enolates

Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate, Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate.

Alkylation of 1,3-dithianes. Alkylation and acylation of enamines.

B. Carbohydrates

Classification and nomenclature. Monosaccharides, mechanism of osazone formation, inter conversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erithro and threo diastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters, Determination of ring size of monosaccharides. Cyclic structure of D(+)- glucose. Mechanism of mutarotation.

Structure of ribose and deoxyribose.

An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides(starch and cellulose) without involving structure determination.

C. Amino Acids, Peptides, Proteins and Nucleic Acids

Classification, structure and stereochemistry of amino acids. Acid base behaviour, isoelectric point and electrophoresis. Preparation and reactions of α-amino acids.

Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Structures of peptides and proteins, level of protein structure. Proteins denaturation/ renaturation.

Nucleic acids: introduction, Constitution of nucleic acids. Ribnonucleosides and ribonucleotides. The double helical structure of DNA.

UNIT-III

A. Fats, Oil and Detergents

Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value. Soaps, synthetic detergents, alkyl and aryl sulphonates.

B. Synthetic Polymers

Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers.

Condensation or step growth polymerization. Polyesters, polyamides,

phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes.

Natural and synthetic rubbers.

C. Synthetic Dyes

Colour and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orange, Congo red, malachite green, Crystal violet, Phenolphthalein, Fluorescein, Alizarin and indigo.

PAPER-III PHYSICAL CHEMISTRY

Time : 3 Hours **Max. Marks: 75**

UNIT-I

A. Elementary Quantum Mechanics

Black-body radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects, Compton effect.

de Broglie hypothesis, the Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates, of quantum mechanics, particle in a one dimensional box.

Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

B. Molecular orbital theory, basic ideas- criteria for forming M.O from A.O, construction of M.O's by LCAO-H_2^+ ion, calculation of energy levels from wave functions, physical picture of bonding and antibonding wave functions, concept of σ, σ^*,π, π^* orbitals and their characteristics. Hybrid orbitals- sp, sp^2, sp^3, calculation of coefficients of A.O.'s used in these hybrid orbitals.

Introduction to valence bond model of H_2, comparison of M.O. and V.B. models.

UNIT-II

A. Spectroscopy

Introduction : electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.

B.Rotational Spectrum

Diatomic molecules, Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect.

C. Vibrational Spectrum

Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

Raman Spectrum concept of polarizability. pure rotational and pure vibrational Raman Spectra of diatomic molecules, selection rules.

D. Electronic Spectrum

Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Frank-Condon principle.

Qualitative description of σ, π- and n M.O., their energy levels and the respective transitions.

UNIT-III

A. Photochemistry

Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus-Drapper law, Stark-Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluroscence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions- energy transfer processes (simple examples)

B. Chemical Kinetics and Catalysis

Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction- concentration, temperature, pressure, solvent, light, catalyst. Concentration dependence of rates, mathematical characteristics of simple chemical reactions-zero order, first order, second order, pseudo order, half life and mean life. Determination of the order of reaction- differential method, method of integration, method of half life period and isolation method. Example of SN_1 and SN_2 and solvolysis of alkyl halides.

Radioactive decay as a first order phenomenon,

Experimental methods of chemical kinetics: conductometric, potentiometric, optical methods, polarimetry and spectrophotometer.

Theories of chemical kinetics: effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy.

Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis) Expression for the rate constant based on equilibrium constant and thermodynamic aspects. Complex reaction kinetics, parallel reaction, reversible reaction and conjugative reactions.

PAPER-IV INDUSTRIAL CHEMISTRY

Time: 3 Hrs. **Max. Marks:75**

Unit-I

A. Glass Industry: Introduction, classification of glass, basic raw materials of glass, manufacturing processes including chemical reactions, some special glasses: optical glass, coloured glass, fiber glass, laminate glass, safety glass, photosensitive glass, photo chromatic glass, lead glass, borosilicate glass and glass wool.

B. Ceramics: Introduction, classification, properties, basic raw materials

for ceramic manufacture, manufacturing processes, enamels, dielectric ceramics, magnetic ceramics and electronic ceramics. Refractories.

C. Cement Industry : Types of cement manufacture of Portland cement composition, setting and hardening of cement, Mortars and concrete, gypsum, plaster of paris, estimation of silica, alumina, calcium oxide and sulphates in Portland cement.

Unit-II

A. Polymer Characterization

Polydispersion-average molecular weight concept. Number, weight and viscosity average molecular weights. Polydispersity and molecular weight distribution. The practical significance of molecular weight. Measurement of molecular weights. End-group, viscosity, light scattering, osmotic and ultracentrifugation methods. Analysis and testing of polymers-chemical analysis of polymers, spectroscopic methods, X-ray diffraction study, Microscopy. Thermal analysis and physical testing-tensile strength. Fatigue, impact. Tear resistance. Hardness and abrasion resistance.

B. Structure and Properties of polymer

Morphology and order in crystalline polymers-configurations of polymer chains. Crystal structure of polymers. Morphology of crystalline polymers, strain induced morphology, crystallization and melting. Polymer structure and physical properties- crystalline melting point Tm- melting points of homogeneous series, effect of chain flexibility and other steric factors, entropy and heat of fusion. The glass transition temperature, Tg-Relationship between Tm and Tg, effects of molecular weight, diluents, chemical structure, chain topology, branching and cross linking. Property requirements and polymer utilization.

Unit-III

A. Paper and Pulp Industry: Manufacture of pulp mechanical and chemical pulping, manufacturing of paper.

B. Soaps and Synthetic Detergents: Manufacture of detergent, types of detergents, manufacture of Soap, Liquid soap,. Analysis of anionic, cationic, nonionic and amphoteric detergents

C. Commercial Polymers

Polyethylene, polyvinyl chloride, polyamides, polyesters, phenolic resins, epoxy resins . Functional polymers- Fire retarding polymers and electrically conducting polymers.

PAPER-V- PRACTICALS

Time: 10 Hours **Max. Marks: 100**

INORGANIC CHEMISTRY

(A) Instrumentation

Colorimetry

(a) Job's method (b) Mole-ratio method (c) water analysis.

OR

(i) Solvent Extraction: Separation and estimation of Mg(II) and Fe(II)

(ii) Ion Exchange Method: Separation and estimation of Mg(II) and Zn(II).

(B) Synthesis and Analysis(Any two)

(a) Preparation of sodium trioxalato ferrate (III), $Na_3[Fe(C_2O_4)_3]$

(b) Preparation of Ni-DMG complex,$[Ni(DMG)_2]$

(c) Preparation of copper tetrammine complex $[Cu(NH_3)_4]SO_4$.

(d) Preparation of cis-and trans-bisoxalato diaqua chromate (III) ion.

Organic Chemistry

(A) Qualitative Analysis

Analysis of an organic mixture containing two solid components using water, $NaHCO_3$, NaOH for separation and preparation of suitable derivatives.

(B) Laboratory Techniques

Steam Distillation

Naphthalene from its suspension in water

Clove Oil from cloves

Separation of o-and-p-nitrophenols

OR

Column Chromatography

Separation of fluorescene and methylene blue

Separation of leaf pigments from spinach leaves

Resolution of racemic mixture of (±) mandelic acid

(E) Synthesis of Organic Compounds(Any Three)

(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 electrophilic substitution
Nitration
Preparation of m-dinitrobenzene
Preparation of p-nitroacetanilide
Halogenation
Preparation of p-bromoacetanilide
Preparation of 2,4,6- tribromophenol

(d) Diazotization/coupling
Preparation of methyl orange and methyl red

(e) Oxidation
Preparation of benzoic acid from toluene

(f) Reduction
Preparation of aniline from nitrobenzene
Preparation of m-nitroaniline from m-dinitrobenzene.

OR

Stereochemical Study of Organic Compounds via Models

(i) R and S configuration of optical isomers.

(ii) E,Z configuration of geometrical isomers.

(iii) Conformational analysis of cyclohexane and substituted cyclohexanes.

F) Preparation /isolation of (any seven)

1. Preparation of Aspirin

2. Preparation of Paracetamol
3. Indigo
4. Methyl Orange
5. Isolation of Caffine from tea leaves.
6. Isolation of Casein from milk
7. Isolation of Nicotine dipricate from tobacco.
8. Isolation of Piperine from black pepper.
9. Analysis of calcium from milk powder by complexometrically.
10. Analysis of sodium using flame photometry.
11. Analysis of cement or dolomite.
12. Preparation of urea-formaldehyde resin.
13. Preparation of plfenol-Formaldehyde resin

(G) PHYSICAL CHEMISTRY (ANY SIX)

1. To determine the strength of the given acid conductometrically using standard alkali solution.
2. To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically.
3. To study the saponification of ethyl acetate conductometrically
4. To determine the ionisation constant of a weak acid conductometrically.
5. To titrate potentiometrically the given ferrous ammonium sulphate solution using $KMnO_4/K_2Cr_2O_7$ as titrant and calculate the redox potential of Fe++/Fe+++ system on the hydrogen scale.
6. To verify law of refraction of mixtures (e.g. of glycerol and water) using Abbe's refractometer.
7. To determine the specific rotation of a given optically active compound
8. Determination of molecular weight of a non-volatile solute by Rast method/ Backmann freezing point method.
9. Determination of the apparent degree of dissociation of an electrolyte (e.g. NaCl) in aqueous solution at different concentrations by ebullioscopy.
10. To verify Beer- Lambert law for $KMnO_4/K_2Cr_2O_7$ and determine the concentration of the given solution of the substance.

Books Suggested (Laboratory Courses)

1. Vogel's Qualitative Inorganic Analysis, revised, Svehla, Orient Longman.
2. Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett, R.C. Denney, G.H. Heffery and J Mendham, ELBS.
3. Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.
4. Experimenal inorganic Chemistry, W.G Palmer, Cambridge.
5. Handbook of Preparative Inorganic Chemistry , Vol, I & II Brauer, Academic Press.
6. Inorganic Syntheisis, McGraw Hill.
7. Experimental Organic Chemistry Vol. I&II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
8. Laboratory Manual in Organic Chemistry, R.K. Babsal, Wiley Eastern.
9. Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G Smith and A.R. Tatchell, ELBS.

10. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal,East-West press.
11. Experiments in Physical Chemistry, R.C. Das and B. Behra. Tata McGraw hill.
12. Advanced Practical Physical Chemistry, Vol.I-Physical. J.B.Yadav,Goel Publishing House.
13. Advanced Experimental Chemistry, Vol.I-Physical, J.N. Gurtu and R.Kapoor, S Chand & Co.
14. Selected Experiments in Physical Chemistry, N.G Mukherjee . J.N. Ghose & Sons.
15. Experiments in Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

SCHEME OF EXAMINATION B.SC. (HONS.) PT-III

Time: 10 Hours **Max. Marks:100**

INORGANIC		
(A) Instrumentation (one exercise)	=	**10**
(B) Synthesis & Analysis (one exercise)	=	**10**
ORGANIC		
(C) Qualitative Analysis	=	10
(D) Laboratory Techniques (one)	=	10
(E) Synthesis of organic compound (One)	=	10
PHYSICAL		
(F) Preparation or Isolation (one)	=	20
(G) One experiment is to be performed	=	20
Viva	=	05
Record	=	05

MATHEMATICS

SCHEME

Paper	Nomenclature	Teaching Hours/week	Examination Duration	Maximum Science
I	Abstract Algebra	5	3 Hrs.	80
II	Analysis	5	3 Hrs.	80
III	Numerical Analysis and Difference Equation	5	3 Hrs.	80
IV	Dynamics of Rigid Bodies	5	3 Hrs.	80
V	Fundamental of " C " (Theory)	3	3 Hrs.	50
	(Practicals)	2	2 Hrs.	30
	Max. Marks			400
	Min. pass Marks			160

PAPER I - ABSTRACT ALGEBRA

Duration:3Hrs. **Max.Marks : 80**

Note 1. Common paper will be set for both the faculties of Social sciences and Science. However the marks obtained by candidates in the faculty of Social sciences will be converted according to the

ratio of the maximum marks of the paper in two faculties .

Note 2. Each theory paper is divided into three independent units. The question paper is divided into three parts Part-A, Part-B and Part-C.

Part A **(16 Marks)** is ***compulsory*** and contains 10 questions (20 words) at least 3 questions from each unit, each question is of 1.6 marks.

Part B **(16 Marks)** is ***compulsory*** and contains 5 questions (50 words) at least one question from each unit. All questions carry equal marks.

Part C **(48 Marks)** contains 6 questions two from each unit. Candidate is required to attempt 3 questions one from each Unit. Each question is of 16 marks (400 words).

Unit - I (Ring theory)

Ring, Examples of Rings, Ring with unity, Zero divisors, Integral Domain and Fields, their examples and properties. Characteristic of a ring and intergral don ain. Subrings, subfields, Prime filed, Ring homomorphism, Embedding of Rings, Field of quotients of an integral domain.

Ideals and their properties. Principal ideal and principal ideal ring, Prime ideal, Maximal ideal. Ideals and Quotient rings, Euclidean rings, Unique Factorisation Domain, Polynomial rings, Remainder theorem, Factor theorem, Polynomials over the rational fields.

Unit - II (Linear Algebra)

Vector Spaces : Definition and examples of a vector spaces, subspaces. Sum and direct sum of subspaces, linear span, linear Dependence, Independence and their basic properties, Basis, finite dimensional vector spaces, Existence theorem for basis, invariance on the number of elements of a basis set, Dimension, existence of complimentary subspace of a subspace of a finite dimensional vector space, dimension of sums of subspaces, quotient space and its dimension.

Linear transformations : Linear Transformations and their representation as matrices,thealgebra of linear transformations, Syllaster Law of Nullity.

Unit - III

Change of basis, Dual space,Dual Basis, Bidual space, Adjoint of a linear transformation, Annihilator of a sub space.

Eigenvalues and Eigenvectors, Similar matrices, equivalent matrices, Similarity of Linear transformations, Reduction to triangular form, Minimal Polynomial. Diagonalisation of Matrices.

PAPER II - ANALYSIS

Duration:3Hrs. **Max.Marks : 80**

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Note 2. Each theory paper is divided into three independent units. The question paper is divided into three parts Part-A, Part-B and Part-C.

Part A **(16 Marks)** is ***compulsory*** and contains 10 questions (20 words) at least 3 questions from each unit, each question is of 1.6 marks.

Part B **(16 Marks)** is ***compulsory*** and contains 5 questions (50 words) at least one question from each unit. All questions carry equal marks.

Part C **(48 Marks)** contains 6 questions two from each unit. Candidate is required to attempt 3 questions one from each Unit. Each question is of 16 marks (400 words).

Unit - I (Metric Spaces)

Real Number System as a complete Ordered Field.

The point set theory, Open and Closed sets, Limit point of a set, Neighbourhood, Bolzano-Weierstrass theorem, Heine-Borel theorem, Compactness, connectedness, Cantor's ternary set.

Definition and example of a metric space, Diameter of a set, Bounded set, Open sphere, Interior point and Interior of a set, Derived and Closure of set, Closed set, Closed Sphere, Properties of Open and Closed sets, Boundary point of set.

Unit - II

Convergent and Cauchy sequences, Complete metric space, Cantor's Intersection theorem. Dense subset, Baire Catagory theorem.

Limit of a function, Continuous function, Theorem on necessary and sufficient conditions for continuity of a function, Uniform continuity, Contracting mapping, Banach Fixed Point theorem, Equivalant matrices, Compactness, Sequentially compactness, Totally Bounded space, Finite Intersection properties.

Unit - III (Complex Analysis)

Complex Numbers as ordered pairs, Complex plane, Geometrical representation, Connected and compact sets, Curves and region in the complex plane, Statement of Jordan curves theorem, Extended complex plane and stereographic projection, Complex valued functions limits, Convergence, continuity,

Differentiailbility in the extended plane, Analytic functions.Cauchy-Reimann equations (Cartesian and Polar forms).

Harmonic functions, Construction of an analytic function, Conformal mapping, Bilinear transformation and its properties, Fixed points, Cross ratio, Inverse point, Elementary maps.

$F(z) = 1/2\,(z+1/z)$, Z2, 2z, sinz and logz.

PAPER III - NUMERICAL ANALYSIS AND DIFFERENCE EQUATIONS

Duration: 3 Hrs. **Max.Marks : 80**

Note 1 The use of non-programmable scientific calculator is permissible.

A note to this effect be mentioned in the question paper also.

Note 2. Common paper will be set for both the faculties of Social sciences and Science. However the marks obtained by candidates in the faculty of Social sciences will be converted according to the ratio of the maximum marks of the paper in two faculties .

Note 3. Each theory paper is divided into three independent units. The question paper is divided into three parts Part-A, Part-B and Part-C.

Part A **(16 Marks)** is ***compulsory*** and contains 10 questions (20 words) at least 3 questions from each unit, each question is of 1.6 marks.

Part B **(16 Marks)** is ***compulsory*** and contains 5 questions (50 words) at least one question from each unit. All questions carry equal marks.

Part C **(48 Marks)** contains 6 questions two from each unit. Candidate is required to attempt 3 questions one from each Unit. Each question is of 16 marks (400 words).

UNIT-I

Difference operators and factorial motation, Relation between differences and derivatives, difference of polynominal , Newton's formulae for forward and backward interpolation for equal intervals.

Divided difference, relation between divided differences and simple, Differences, Newton's general interpolation formula, Lagrange's interpolation formula, Gauss central difference formula, Stirling and Bessel interpolation formulae.

UNIT-II

Inverse interpolation, Lagrange's formula, Numerical differentiation and integration, Trapezoidal,Simpson's 1/3, 3/8 rules Weddle's rule,Solution of algebraic and Transcendental equations, Bisection method, Regula-Falsi Method, Newton-Raphson method.

UNIT-III

Defination and order of a difference equation. First and highest order homogeneous form ,Non-homogeneous linear difference equations, Non-homogenous linear difference equation reducible to homogeneous form, Non- homogeneous linear difference equations, Generating function of a sequence and its use in the solution of difference equation.Complimentary functions, Particular integral.

Summation of series,Eigen value and eigen vecyors. Boundery value problems.

PAPER IV - DYNAMICS OF RIGID BODIES

Duration :3Hrs. **Max.Marks : 80**

Note 1 The use of non-programmable scientific calculator is permissible. A note to this effect be mentioned in the question paper also.

Note 2. Common paper will be set for both the faculties of Social sciences and Science. However the marks obtained by candidates in the faculty of Social sciences will be converted according to the ratio of the maximum marks of the paper in two faculties .

Note 3. Each theory paper is divided into three independent units. The question paper is divided into three parts Part-A, Part-B and Part-C.

Part A **(16 Marks)** is ***compulsory*** and contains 10 questions (20 words) at least 3 questions from each unit, each question is of 1.6 marks.

Part B **(16 Marks)** is ***compulsory*** and contains 5 questions (50 words) at least one question from each unit. All questions carry equal marks.

Part C **(48 Marks)** contains 6 questions two from each unit. Candidate is required to attempt 3 questions one from each Unit. Each question is of 16 marks (400 words).

UNIT-I

Moment of Inertia, Products of Inertia, Theorem of Parallel Axes. The Momental Ellipsoid, Equimomental Systems, Principal Axes.

UNIT-II

D' Alembert's principal, The general equation of a rigid body, Motion of the centre of inertia and motion relative to the centre of inertia.Motion about a fixed axis, The compound pendulum, Centre of precussion.

UNIT-III

Motion of a rigid body in two dimensions under finite and impulsive forces. Conservation of Momentum and Energy, Lagrange's equations, Inital Motions.

PAPER V - FUNDAMENTALS OF "C"

Part'A'- Theory

Duration:3Hrs. **Max.Marks : 50**

Note 1. Common paper will be set for both the faculties of Social sciences and Science. However the marks obtained by candidates in the faculty of Social sciences will be converted according to the ratio of the maximum marks of the paper in two faculties .

Note 2. Each theory paper is divided into three independent units. The question paper is divided into three parts Part-A, Part-B and Part-C.

Part A **(16 Marks)** is ***compulsory*** and contains 10 questions (20 words) at least 3 questions from each unit, each question is of 1.6 marks.

Part B **(16 Marks)** is ***compulsory*** and contains 5 questions (50 words) at least one question from each unit. All questions carry equal marks.

Part C **(48 Marks)** contains 6 questions two from each unit. Candidate is required to attempt 3 questions one from each Unit. Each question is of 16 marks (400 words).

UNIT - I

C Language:Main characteristics , constant, variable ,Data types. Declaration of variables, Elements related to Programme Development.

Operators, Precedence , associativity and Priority of operations, Input and output statement ,Decision Making Statement.

UNIT - II

Looping and branching , while statement, Do statement ,For statement go to statement, continue statement, switch statement , break statement, conditional Branching, looping nested.

UNIT - III

Initalization of Array, Two Dimenssional array , Multidimensional arrays, character strings, strings functions : strcat ( ) ,str cmp( ), strepy ( ) ,User-defined functions.

Structures, Unions, pointers, pointers Arithmetic, Passing pointers as functions arguments, Arrays of Pointers.

PART'B'- PRACTICALS

Duration :2Hrs. **Max.Marks : 30**

Note: Distribution of marks is as follows:

A.	One practical from 1 to 5	10
B.	One practical from 6 to 10	10
C.	Practical record	5
D.	Viva voce	5

1. A program employs different kind of operators.
2. Programme for gradation system for exam
3. Programme to calculate roots of guadratic equation
4. Programme to find factorial of a number
5. Programme to find sum of a series
6. Programme to find following output

K
KA
KAR
KARA
KARAN
KARA
KAR
KA
K

7. Programme to stores roll number and total marks.
8. Programme to evaluate Simple arithmetic expression by using pointers.
9. Programme to copu a string on other string and calculate the number of characters
10. Programme to evaluate Total = $\sum (x_i)^2$

□□□