



पाठ्यक्रम
SYLLABUS

SCHEME OF EXAMINATION AND COURSES OF STUDY

FACULTY OF SCIENCE

M.Phil Chemistry

M.Phil Examination Semester-I, Semester-II

2011-12 से प्रभावी(w.e.f.)

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 पुनः 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।

**MAHARSHI DAYANAND SARASWATI UNIVERSITY,
AJMER****Ordinance 123 (V) relating to M. Phil Examination
According to Minimum standards and procedure for awards of
M. Phil degree as per the guidelines of U.G.C. Regulation, 2009
Scheme of Examination**

1. For starting or continuing M. Phil course in the University and its affiliated colleges, it must be ensured that at least two qualified teachers are available in that subject. A teacher who possesses Ph.D. Degree shall be eligible to teach M. Phil classes. A teacher who possesses Ph.D. Degree and three years P.G. teaching experience shall be eligible to supervise M. Phil dissertation.
2. A candidate for admission to the courses of study for the Degree of M.Phil must have obtained a Master's Degree in the concerned subject with at least 55% marks at the post graduate Examination of this University or of any other University/ Institution . A candidate with second division at post graduate examination (with less than 55% marks) shall be eligible for the M.Phil. if he/she has second division at the graduate examination. Relaxation in the eligibility will be given to SC/ST/OBC/PH etc as per rules of the University/State Government.
3. **Admission to M. Phil Programme**
 - (i) University shall issue notification regarding Eligibility test for admission to M.Phil Programme. Research Eligibility Test (RET-M.Phil) in the National/Regional news papers etc.
 - (ii) University shall conduct RET-M.Phil on the date notified once every year.
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 - (iv) The University shall prepare a merit list of the eligible candidates.
4. **Procedure for Admission to M.Phil Programme**
A merit list shall be prepared of the eligible candidates based on the weightage of percentage of the academic record such as Sr. Secondary, Graduation, Post Graduation, publication in the peer reviewed journal, presentation of paper in National/International Conference/Seminar/ Workshop shall be as follows:

1. Sr. Secondary	10% of the percentage obtained
2. Graduation	20% of the percentage obtained
3. Post graduation	60% of the percentage obtained
4. Publication	05*
5. Conference/seminar	05**

(*2.5 marks for each publication with maximum 5 Marks,
** 2.5 marks for each conference/seminar with maximum 5 marks)

The number of candidates called for interview shall be twice the availability of seats. Allocation for the candidates for the University and colleges shall be faculty wise and centralized at the University campus.

5. **Students allotment Committee**

The Composition of the Committee shall be as follows:

- (i) Dean P.G.Studies
- (ii) Dean Concerning Faculty
- (iii) Head of the Department/Incharge/Director of the concerning teaching Department of the University/College
- (iv) Principal or his/her nominee (in the case of College)
- (v) Director Research (Member Secretary)

6. **Research Eligibility Test (RET-M.Phil)**

A. Procedure

There shall be a Research Eligibility Test for M.Phil. of 200 marks comprising of two papers of 100 marks of two hours duration each. Both the papers will be held on the same day with a gap of one hour. A candidate who does not appear in paper I shall not be allowed to appear in paper II. First paper shall be of Research aptitude and the second paper shall be subject paper based on the concerned subject.

B. Syllabus

Syllabus of paper First shall be based on research aptitude and the Second paper shall be based on the common papers of syllabus of M.D.S. University, Ajmer of their post graduation of the concerned subject. (Except special/optional papers)

Paper I – Research Aptitude

The questions shall be of general nature, intended to assess the research aptitude of the candidate. It will primarily be designed to test reasoning ability, comprehension, divergent thinking, computer skills, elementary statistical methods and general awareness of the candidate. A total of 50 multiple choice questions (MCQ's) will be set. Each question shall carry 2 marks. There will be no negative marking.

Paper II – Subject Paper

There shall be only one subject paper based on the syllabus of the common papers candidate has studied at the post graduation. There will be three sections in this paper.

Section A: 20 question of multiple choice 2 marks each = 40
Section B: 10 question of short answers 3 marks each = 30

Section C: 2 question of long answers 15 marks each = 30
(All Question in Section A and B shall be compulsory. In section C there will be four questions out of which candidate shall be required to attempt any two questions.)

7. The candidate after getting admission in the M.Phil. programme will carry out the M.Phil. studies as per the scheme mentioned below.

Semester Scheme for M.Phil Courses

- (i) M.Phil. course shall be of one academic session to be run under semester scheme and credit system. There will be two semesters in the academic session. Each semester will be of about 20 weeks duration having a minimum of 90 days (16 weeks) of actual teaching, one week for preparatory leave and remaining days for the conduction of examination and other activities. The tentative schedule is as below:
First semester : July to November
Internship: >2 weeks (December)
Second semester: January to May
- (ii) There will be six (6) theory papers in one academic session divided equally into two semesters. The dissertation is in lieu of IV and VIII theory papers in Semester I and II, respectively.
- (iii) The M.Phil. Course shall be of 32 credit hours, i.e. 16 credits per semester.
- (iv) Each theory credit hour shall be designated as 1L that shall be equal to 1 hour of instruction and one dissertation credit hour shall be designated as 1 D credit that shall be equal to 1.5 hour per week. (L = Lecture; D=Dissertation)
- (v) Each theory paper shall be of 4L credits per semester with total 64 hrs of instructions. The semester shall be of about 16 weeks, 4 hrs instructions shall be given to each theory paper per week.
- (vi) The dissertation shall carry 4 D in each semester with total 96 hours of instruction hours per semester. Since a semester shall be of about 16 weeks, 6 hrs instruction per week shall be given to dissertation.
- (vii) Each theory paper shall be of 50 marks and dissertation shall be of 50 marks. There shall be no evaluation of the dissertation at the end of first semester because the work carried out during the first semester shall be continued in the second semester. Evaluation of the dissertation shall be done at the end of the second semester.
- (viii) The distribution of credits and the examination scheme are as below:

Paper	Title	Max. Marks	Credits	Minimum hours of instruction		Minimum hours of self study	
				Per week	Per semester	Per week	Per semester
Semester I							
I	Research	50	4	4	64	4	64
	Methodology						
II	Optional Paper	50	4	4	64	4	64
III	Optional Paper	50	4	4	64	4	64
IV	Dissertation*	—	4	6	96	12	192
Semester I Total		150	16	18	288	24	384
Semester II							
V	Advance	50	4	4	64	4	64
	Research						
	Methodology						
VI	Optional Paper	50	4	4	64	4	64
VII	Optional Paper	50	4	4	64	4	64
VIII	Dissertation*	100	4	6	96	12	192
Semester II Total		250	16	18	288	24	384
Grand total of Semester I & II		400	32		576		768

There will be internship of two to three weeks between two semesters

*Dissertation will begin from semester I and shall complete at the end of the second semester.

- (ix) The total maximum marks for evaluation in M.Phil. shall be 400.
- (x) The time allotted for self study is the minimum time expected to be spent on various activities like practical, field work, library reference work, use of computer and internet and such other facilities.
- (xi) There shall be one paper-on Research Methodology (Paper-I) in Semester I and one on Advance Research Methodology in Semester II.
- (xii) Papers II, III shall be optional paper in Semester I and paper VI and VII shall be optional in II Semester.
- (xiii) Out of a maximum of 50 marks in each theory paper 15 marks (30%) shall be for the continuous sessional assessment to be done internally based on assignments (5 marks), written test (5 marks) and seminar/group discussion (5 marks). The internal assessment marks should be sent to

the University by the various Departments/Affiliated Colleges of the University before the commencement of theory examination. The theory examination will be held at the end of each semester. Each theory paper shall be assessed out of a maximum of 35 marks

- (xiv) All paper setters and examiners for the external assessment shall be external persons (i.e. those who are not working either in the M.D.S University or in any of its affiliated colleges). The Board of studies shall prepare a separate panel of Examiners for M. Phil. theory papers as well as dissertation. Appointment of the paper setters and examiners shall be made on the recommendations of the committee for selection of the examiners.
- (xv) The answer books of theory papers of external examination shall be evaluated by single examiner. After declaration of the result the student concerned if desires shall be entitled for re-evaluation in accordance with the provisions of the university. Dissertation shall be evaluated by two examiners.
- (xvi) The student will have to carry out the work of dissertation in both the semesters and shall submit the thesis for evaluation within two weeks after the last theory examination of II Semester.
- (xvii) Dissertation work shall be conducted by the candidate under the supervision of any teacher who is registered as M.Phil. Supervisor with the teaching department concerned. An M.Phil. Supervisor can normally guide five dissertations at a time. However, the maximum limit may be relaxed by the Vice-chancellor on the recommendation of the Head. The work load for dissertation shall be six hours per week per class.
- (xviii) For dissertation work the placement of every candidate under a supervisor shall be decided within one month from the last date of admission.
- (xix) The dissertation will be divided into two parts. Part I of Semester I will constitute preparation of plan of work that should be presented by the student in front of the faculty of the department, who will assess the feasibility and recommend suggestions, if any, for the improvement. The student must suitably incorporate the changes, if any, in the synopsis in consultation with the supervisor. Following this he/she must write and submit type written draft of chapters on review of literature and methodology to the supervisor. He/she may also conduct some preliminary work/experiments to understand the techniques. The supervisor shall submit a report of satisfactory progress to the Head of the Department before beginning of the theory examination. The latter shall forward it to the university along with marks for internal assessment. The dissertation shall be of 100 marks to be evaluated out of 70 marks by an external examiner. The marks obtained, shall be added to the marks obtained in the viva voce examination to be held subsequently.

- (xx) In the second part of dissertation in Semester II, the student will have to complete the work as per the aims and objectives of the study and submit a dissertation. Prior to final submission of the dissertation, the student shall make a pre- M. Phil. presentation in the department in the presence of all the faculty chaired by the Head of the Department . Suggestions, if any, may be suitably incorporated into the dissertation.
- (xxi) The candidate must give a certificate that (1) the dissertation incorporates his/her own work, (2) the work incorporated in the dissertation is not a repetition of earlier work, (3) any part of the dissertation containing information from other sources has been properly cited or has been printed after having obtained due permission from the original author, and (4) any kind of assistance or help taken during the course of work has been properly acknowledged. This certificate must be attached immediately after the title page of the dissertation. Supervisor shall give a certificate according to the prescribed format ((Annexure-I)
- (xxii) The dissertation must be hard bound and type written dissertation on A-4 size paper. Four hard copies and four soft copies in non-editable PDF format must be submitted to the Head of the Department through the Supervisor. The colour of the cover page of dissertation shall be faculty wise (Annexure-II).
- (xxiii) On receipt of satisfactory evaluation report of dissertation, i.e., minimum 50% marks M. Phil. students shall undergo a viva voce examination of 30 marks which shall also be openly defended. There will be an examination committee comprising one external examiner and one internal examiner; the later may be the supervisor of the candidate or the Head of the Department in the absence of the supervisor.
- (xxiv) Every student shall be required to undertake a compulsory internship of 2-3 weeks in between the two semesters. The internship schedule shall be decided by the concerning Head of the Department. The teaching institution may decide for the provision of stipend for the students taking internship. The students will be required to submit and present a report of the internship. The participating organization/institution will give the performance appraisal of the student's work. The concerning supervisor of the Department shall certify the satisfactory performance of the students during internship and submit the same to the examination section through the Head of the Department of the university.
- (xxv) Every candidate shall be required to attend a minimum of 75% of the lectures, tutorials, seminars and practical (taken together) held in each paper.
- (xxvi) Every student of semester I shall be promoted to the next semester at her/his own risk in case he/she qualifies in 50% of papers (2 theory papers of semester I)

- (xxvii) The student who fails in any paper of Semester Ist or IInd shall appear in the due paper in the next year along with the concerned Semester.
- (xxviii) The award list should show both, total marks of the continuous internal assessment as well as external assessment in the theory papers separately and the third column must have the aggregate marks of the two. The candidate will be considered pass on the basis of the combined total marks secured in each paper.
- (8) For a pass, a student will have to obtain (a) at least 40% marks in each paper separately and (b) a minimum of 50% marks in the aggregate of all the papers prescribed for the examination. In the marksheet, successful candidates shall be classified as under:

Pass	50% or more but less than 55% marks in the aggregate
Second Division	55% or more but less than 65% marks in the aggregate
First Division	65% or more but less than 75% marks in the aggregate
First Division with Distinction	75% or more marks in the aggregate

A candidate who fails at the examination even in one paper/dissertation shall be required to reappear at the examination in a subsequent year in all the papers/dissertation prescribed for the examination, provided that a candidate who obtains at least 50% marks in dissertation shall be exempted from submitting a fresh dissertation and the marks obtained by him shall be carried forward for working out his result.

9. Depository with UGC

- (i) Following the successful completion of the evaluation process and announcements of the award of M.Phil the University shall submit a soft copy of the M.Phil dissertation obtained from the candidate to the UGC, for hosting the same in INFLIBNET accessible to all Institution/ Universities.
- (ii) Along with the Degree, the University, shall issue a Provisional Certificate certifying to the effect that the Degree has been awarded in accordance with the provisions to these Regulations of the UGC.

Semester I

PAPER-1 RESEARCH METHODOLOGY

- A. Research: Definition and type of research
 Problem : Identification and selection of problem
 Research Design: Meaning, definition and characteristics of research design.
- B. Writing of research proposal, Literature survey, methodology and data collection, sampling techniques, field questionnaire.
- C. Primary and secondary data , familiarity with ideas and concepts of investigation, acquiring technical skills, drawing inference from data, qualitative and quantitative analysis, assessing the problems.

PAPER-2 ADVANCE CONCEPTS IN INORGANIC CHEMISTRY

- A Solid State Chemistry and Structure : Imperfections and properties of solids such as ionic conductivity , diffusion . Ferroelectric properties, luminescence , optical and thermal excitation in solids , phosphorescence and laser properties of inorganic compounds . Methods of analyzing solid state dislocations, their mechanism and reactions , superconductivity due to imperfections in solids, n-type and p-type dopants with specific examples.
- B. Ceramics :Definition, basic concepts,classification based on reduction in porosity, traditional ceramics powder for engineering ceramics , additives and chemicals,waste materials and function of main raw materials in various ceramic body.
 Various types of machines used for production of ceramics such as ball mills, filter press, pug mill, jolly, jigger, toddle press, mechanical press, hydraulic press, iso-static press, spray,drier.
 Various casting methods:- Extrusion methods, press method, injection moulding, dry pressing, isostatic pressing, HIP, slip casting.
 Application of colours to pottery, applications of important ceramics.
- C. Polymers and Macromolecules: Nature of Macromolecule, force involved in high polymer interactions, methods for studying size and shapes of polymers by various experimental techniques, sedimentation, ultracentrifuge, viscosity, electrophoretic and diffraction methods,

configuration of polymer molecules, rubber, elasticity and crystallinity of polymer structure. Transition Helix Coil Transition, optical methods for studying transitions and ORD mechanism of coordination on catalytic compounds

PAPER-3 ADVANCED CONCEPTS IN ORGANIC CHEMISTRY

- A. Planning and designing of organic synthesis – A Retro synthetic approach :
 Selection of target molecules, Retro synthetic analysis – A disconnection of targets using various aspects like one group disconnection, two group disconnection, illogical two group disconnection, disconnection in heterocyclic compounds, disconnection in small ring compounds etc. Planning and designing of the synthesis using appropriate disconnection, use of umpolung of carbonyl reactivity, use of pericyclic reactions, use of ketenes, use of radical reactions etc. Protection and deprotection of various groups. Use of FGI and FGA in synthesis, use of Chiron approach in organic synthesis.
- B. Green chemistry:
 Introduction of green chemistry, atom economy, less hazardous chemical synthesis, designing safer chemicals, safer solvents and auxillaries, use of ionic liquids, design for energy efficiency, catalysis and analysis for pollution prevention.
- C. Combinatorial Chemistry:
 Introduction of Combinatorial Chemistry, library synthesis on resin beads, solid phases, solution phase library synthesis, peptide libraries, solid phase library chemistry and application of combinatorial chemistry.

PAPER- 4 DISSERTATION

Semester II

PAPER- 5 ADVANCE RESEARCH METHODOLOGY

- A. Confidence limits, statistical aids to hypothesis testing Type I and Type II errors, detection of gross errors, estimation of detection limits, the least square method for drawing calibration plot, quality assurance and control charts, significant figures statistical treatment of data, rejection of data, variance and standard deviation, data analysis, statistical use in chemistry research
- B. Report Writing: Types of manuscript, review, original manuscript, short communication, presenting a scientific seminar, publication of research paper. Basic principle and techniques to be adopted for writing a M.Phil dissertation and Ph.D. Thesis. ISSN No. ISBN No., Citation Index, Impact Factor of Journals
- C. Research Ethics and Plagiarism, types of reference style

PAPER-6 PHYSICAL CHEMISTRY AND SPECTROSCOPY

- A. Chemical Dynamics:
- Free Radical Reaction: Introduction, kinetics characteristics of free radical reactions. Derivation of steady state rate law, absolute reaction rate, kinetics and solvent effects.
- Induced Reaction: Definition, types of induced reactions, examples of induced reactions, induced reactions employing oxidants such as Cr (VI) and Mn (VII), mechanism of induced reactions.
- Fast Reactions: Introduction, difference between slow and fast reactions, experimental techniques for studying of fast reactions such as flow methods and relaxation methods and NMR techniques, flash photolysis.
- Jablonski diagram in photochemical reactions, relative times events.
 - Reaction of Single Molecular Oxygen: Introduction, discovery,

formation methods for detection, estimation and quenching, reaction of singlet molecular oxygen with organic compounds.

Voltammetry & Cyclic voltammetry, Anodic stripping voltammetry

B. Spectroscopy

Electron diffraction : Scattering of electrons by atoms, procedure of obtaining electron diffraction, analysis of results and applications.

Neutron diffraction : Scattering of slow neutrons by atoms, procedures for obtaining neutron diffraction, analysis of results and applications.

Mossbauer Spectroscopy: Introduction, quadrupole and magnetic interactions, application to Be and Sn Systems.

Photo acoustic Spectroscopy: Basic principle of photo acoustic spectroscopy (PAS), PAS gases & condensed systems, chemical & surface application.

Molecular Luminescence Spectroscopy:

Introduction to molecular luminescence (fluorescence, phosphorescence and chemiluminescence); theory of luminescence; instruments for measuring fluorescence (fluorometer and spectrofluorometer); application and problems.

Electron Spectroscopy:

Introduction to electron spectroscopy (ESCA Auger and UPS), principle and theory of ESCA, instrumentation, chemical shifts, satellite peaks and spectral splitting; application and problems.

Principle and electron transition of Auger electron spectroscopy, equipment, applications and problems.

C. Advanced Spectroscopy:

¹³C-NMR Spectroscopy: Difficulties and solution for recording ¹³C-NMR spectra, recording of ¹³C-NMR spectra – scale, solvents, solvent signals and their positions, multiplicity, ¹³C-¹H coupling constant – proton coupled and decoupled ¹³C spectra, broad band decoupling, off resonance technique. Chemical shifts in ¹³C spectra – chemical shift calculation for alkanes, alkenes and alkynes, chemical shift calculation in internal and terminal substituted compounds, aromatic compounds. Use of ¹³C spectra in differentiating stereoisomers, Nuclear Overhauser

Effect. ^{13}C - DEPT spectra – differentiation in primary, secondary and tertiary carbons by DEPT – 45, DEPT – 90, DEPT – 135 spectra.

2D NMR Spectroscopy: Theory and principles of 2D NMR spectroscopy, interpretation of ^1H - ^1H COSY, ^1H - ^{13}C HETCOR, HMQC, HMBC, INADEQUATE spectra.

Mass Spectroscopy: Theory and principles of mass spectroscopy, instrumentation, low and high resolution mass spectra, Ionization techniques – Electron Impact ionization, Chemical Ionization, Field Desorption, Fast Ion Bombardment, Electrospray Ionization and Matrix Assisted Laser Desorption/Ionization. Determination of molecular weight and molecular formula, nitrogen rule, detection of molecular ion peak, metastable ion peak. Fragmentations – rules governing the fragmentations, McLafferty rearrangement. Interpretation of mass spectra of different class of compounds – saturated and unsaturated hydrocarbons, aromatic hydrocarbons, alcohols, ethers, ketones, aldehydes, carboxylic acids, amines, amides, compounds containing halogens.

PAPER -7 CONCEPTS OF ANALYTICAL AND BIOLOGICAL CHEMISTRY

A. Physico Chemical Aspects of Air and Water Pollution

Air Pollution: Air quality standards, sampling and monitoring of air pollutants-gaseous and particulate, sources and effects of air pollution caused by carbon monoxide, oxide of nitrogen, sulphur dioxide, ozone, water vapours, aerosols and minor pollutant gases, indoor pollution, composition of atmosphere -Troposphere Stratosphere, Mesosphere and Thermosphere.

Water Pollution: Water quality parameters and standards, classification and sampling of water pollutants, sources of water pollution- solid waste, industrial, agricultural, oil, radioactive waste, thermal pollution. Instrumental techniques for analyzing metal pollutants in water.

B. Co-enzymes & Metal ions in Biological System

Role of bulk and trace elements in biological systems, micro-elements,

active transport of Na, Mg, and Ca across the biological membrane.

Iron storage and transport, copper proteins, metalloenzymes, general discussion of enzymes functions of metal ions, inhibition (Exploration based on coordination chemistry)

Vitamins B12 and B12 coenzymes

Hypnotics and Sedatives- Barbiturates & Phenobarbitone sodium

CNS Stimulant- Caffeine, ethamivan

C. Chromatographic Techniques

Theory, instrumentation and applications of:

(i) Gas Chromatography

(ii) High Performance Liquid Chromatography

PAPER- 8 DISSERTATION

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Books Recommended:

1. Designing Organic Synthesis – A Programmed introduction to the Synthon Approach Stuart Warren, John Wiley & Sons Ltd.
2. Organic Synthesis – The Disconnection Approach
Stuart Warren, John Wiley & Sons Ltd.
3. Green Chemistry : Theory and Practice
Paul. T. Anastas and John C. Warner
4. Combinatorial Chemistry
Nicholas K. Terrett
Oxford University Press Inc., New York
5. Photochemistry
Vol.32 by Senior Reporter A. Gilbert
The Royal Society of Chemistry, Thomas Graham House, Science Park,
Milton Road, Cambridge CB4 0WF, UK
6. Industrial Ceramics – F. Singer, S. Singer
7. Hand Book Of Ceramics – S. Kumar
8. Spectroscopic Identification of Organic Compounds
R.M. Silverstein and F.X. Webster, 6th edition
John Wiley & Sons
9. Introduction to Spectroscopy
D.L. Pavia, G.M. Lampman and G.S. Kriz, 3rd Edition
Thomas Brooks /Cole
10. Spectroscopic Methods in Organic Chemistry
D.H. Williams and I. Fleming, 4th edition
Mc. Graw Hill Book Company
11. Spectroscopy of Organic Compounds
P.S. Kalsi, 5th edition
New Age International Publishers
12. Principles of Instrumental Analysis
Skoog, Holler and Neiman
Sunders College Publishers (USA)
13. Introduction to Instrumental Analysis
Robert D. Braun
Pharme Med Press Hyderabad - India
14. Instrumental Method of Analysis
Williard, Merritt, Jr., Dean and Settle Jr.
CBS Publishers and Distributors, New Delhi, India

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6. **Research Eligibility Test (RET-M.Phil)**

A. Procedure

There shall be a Research Eligibility Test for M.Phil. of 200 marks comprising of two papers of 100 marks of two hours duration each. Both the papers will be held on the same day with a gap of one hour. A candidate who does not appear in paper I shall not be allowed to appear in paper II. First paper shall be of Research aptitude and the second paper shall be subject paper based on the concerned subject.

B. Syllabus

Syllabus of paper First shall be based on research aptitude and the Second paper shall be based on the common papers of syllabus of M.D.S. University, Ajmer of their post graduation of the concerned subject. (Except special/optional papers)

Paper I – Research Aptitude

The questions shall be of general nature, intended to assess the research aptitude of the candidate. It will primarily be designed to test reasoning ability, comprehension, divergent thinking, computer skills, elementary statistical methods and general awareness of the candidate. A total of 50 multiple choice questions (MCQ's) will be set. Each question shall carry 2 marks. There will be no negative marking.

Paper II – Subject Paper

There shall be only one subject paper based on the syllabus of the common papers candidate has studied at the post graduation. There will be three sections in this paper.

Section A: 20 question of multiple choice 2 marks each = 40
 Section B: 10 question of short answers 3 marks each = 30

Section C: 2 question of long answers 15 marks each = 30
 (All Question in Section A and B shall be compulsory. In section C there will be four questions out of which candidate shall be required to attempt any two questions.)

7. The candidate after getting admission in the M.Phil. programme will carry out the M.Phil. studies as per the scheme mentioned below.

Semester Scheme for M.Phil Courses

- (i) M.Phil. course shall be of one academic session to be run under semester scheme and credit system. There will be two semesters in the academic session. Each semester will be of about 20 weeks duration having a minimum of 90 days (16 weeks) of actual teaching, one week for preparatory leave and remaining days for the conduction of examination and other activities. The tentative schedule is as below:
First semester : July to November
Internship: >2 weeks (December)
Second semester: January to May
- (ii) There will be six (6) theory papers in one academic session divided equally into two semesters. The dissertation is in lieu of IV and VIII theory papers in Semester I and II, respectively.
- (iii) The M.Phil. Course shall be of 32 credit hours, i.e. 16 credits per semester.
- (iv) Each theory credit hour shall be designated as 1L that shall be equal to 1 hour of instruction and one dissertation credit hour shall be designated as 1 D credit that shall be equal to 1.5 hour per week. (L = Lecture; D=Dissertation)
- (v) Each theory paper shall be of 4L credits per semester with total 64 hrs of instructions. The semester shall be of about 16 weeks, 4 hrs instructions shall be given to each theory paper per week.
- (vi) The dissertation shall carry 4 D in each semester with total 96 hours of instruction hours per semester. Since a semester shall be of about 16 weeks, 6 hrs instruction per week shall be given to dissertation.
- (vii) Each theory paper shall be of 50 marks and dissertation shall be of 50 marks. There shall be no evaluation of the dissertation at the end of first semester because the work carried out during the first semester shall be continued in the second semester. Evaluation of the dissertation shall be done at the end of the second semester.
- (viii) The distribution of credits and the examination scheme are as below:

Paper	Title	Max. Marks	Credits	Minimum hours of instruction		Minimum hours of self study	
				Per week	Per semester	Per week	Per semester
Semester I							
I	Research	50	4	4	64	4	64
	Methodology						
II	Optional Paper	50	4	4	64	4	64
III	Optional Paper	50	4	4	64	4	64
IV	Dissertation*	—	4	6	96	12	192
Semester I Total		150	16	18	288	24	384
Semester II							
V	Advance	50	4	4	64	4	64
	Research						
	Methodology						
VI	Optional Paper	50	4	4	64	4	64
VII	Optional Paper	50	4	4	64	4	64
VIII	Dissertation*	100	4	6	96	12	192
Semester II Total		250	16	18	288	24	384
Grand total of Semester I & II		400	32		576		768

There will be internship of two to three weeks between two semesters

*Dissertation will begin from semester I and shall complete at the end of the second semester.

- (ix) The total maximum marks for evaluation in M.Phil. shall be 400.
- (x) The time allotted for self study is the minimum time expected to be spent on various activities like practical, field work, library reference work, use of computer and internet and such other facilities.
- (xi) There shall be one paper-on Research Methodology (Paper-I) in Semester I and one on Advance Research Methodology in Semester II.
- (xii) Papers II, III shall be optional paper in Semester I and paper VI and VII shall be optional in II Semester.
- (xiii) Out of a maximum of 50 marks in each theory paper 15 marks (30%) shall be for the continuous sessional assessment to be done internally based on assignments (5 marks), written test (5 marks) and seminar/group discussion (5 marks). The internal assessment marks should be sent to

the University by the various Departments/Affiliated Colleges of the University before the commencement of theory examination. The theory examination will be held at the end of each semester. Each theory paper shall be assessed out of a maximum of 35 marks

- (xiv) All paper setters and examiners for the external assessment shall be external persons (i.e. those who are not working either in the M.D.S.U. University or in any of its affiliated colleges). The Board of studies shall prepare a separate panel of Examiners for M. Phil. theory papers as well as dissertation. Appointment of the paper setters and examiners shall be made on the recommendations of the committee for selection of the examiners.
- (xv) The answer books of theory papers of external examination shall be evaluated by single examiner. After declaration of the result the student concerned if desires shall be entitled for re-evaluation in accordance with the provisions of the university. Dissertation shall be evaluated by two examiners.
- (xvi) The student will have to carry out the work of dissertation in both the semesters and shall submit the thesis for evaluation within two weeks after the last theory examination of II Semester.
- (xvii) Dissertation work shall be conducted by the candidate under the supervision of any teacher who is registered as M.Phil. Supervisor with the teaching department concerned. An M.Phil. Supervisor can normally guide five dissertations at a time. However, the maximum limit may be relaxed by the Vice-chancellor on the recommendation of the Head. The work load for dissertation shall be six hours per week per class.
- (xviii) For dissertation work the placement of every candidate under a supervisor shall be decided within one month from the last date of admission.
- (xix) The dissertation will be divided into two parts. Part I of Semester I will constitute preparation of plan of work that should be presented by the student in front of the faculty of the department, who will assess the feasibility and recommend suggestions, if any, for the improvement. The student must suitably incorporate the changes, if any, in the synopsis in consultation with the supervisor. Following this he/she must write and submit type written draft of chapters on review of literature and methodology to the supervisor. He/she may also conduct some preliminary work/experiments to understand the techniques. The supervisor shall submit a report of satisfactory progress to the Head of the Department before beginning of the theory examination. The latter shall forward it to the university along with marks for internal assessment. The dissertation shall be of 100 marks to be evaluated out of 70 marks by an external examiner. The marks obtained, shall be added to the marks obtained in the viva voce examination to be held subsequently.

- (xx) In the second part of dissertation in Semester II, the student will have to complete the work as per the aims and objectives of the study and submit a dissertation. Prior to final submission of the dissertation, the student shall make a pre- M. Phil. presentation in the department in the presence of all the faculty chaired by the Head of the Department . Suggestions, if any, may be suitably incorporated into the dissertation.
- (xxi) The candidate must give a certificate that (1) the dissertation incorporates his/her own work, (2) the work incorporated in the dissertation is not a repetition of earlier work, (3) any part of the dissertation containing information from other sources has been properly cited or has been printed after having obtained due permission from the original author, and (4) any kind of assistance or help taken during the course of work has been properly acknowledged. This certificate must be attached immediately after the title page of the dissertation. Supervisor shall give a certificate according to the prescribed format ((Annexure-I)
- (xxii) The dissertation must be hard bound and type written dissertation on A-4 size paper. Four hard copies and four soft copies in non-editable PDF format must be submitted to the Head of the Department through the Supervisor. The colour of the cover page of dissertation shall be faculty wise (Annexure-II).
- (xxiii) On receipt of satisfactory evaluation report of dissertation, i.e., minimum 50% marks M. Phil. students shall undergo a viva voce examination of 30 marks which shall also be openly defended. There will be an examination committee comprising one external examiner and one internal examiner; the later may be the supervisor of the candidate or the Head of the Department in the absence of the supervisor.
- (xxiv) Every student shall be required to undertake a compulsory internship of 2-3 weeks in between the two semesters. The internship schedule shall be decided by the concerning Head of the Department. The teaching institution may decide for the provision of stipend for the students taking internship. The students will be required to submit and present a report of the internship. The participating organization/institution will give the performance appraisal of the student's work. The concerning supervisor of the Department shall certify the satisfactory performance of the students during internship and submit the same to the examination section through the Head of the Department of the university.
- (xxv) Every candidate shall be required to attend a minimum of 75% of the lectures, tutorials, seminars and practical (taken together) held in each paper.
- (xxvi) Every student of semester I shall be promoted to the next semester at her/his own risk in case he/she qualifies in 50% of papers (2 theory papers of semester I)

- (xxvii) The student who fails in any paper of Semester Ist or IInd shall appear in the due paper in the next year along with the concerned Semester.
- (xxviii) The award list should show both, total marks of the continuous internal assessment as well as external assessment in the theory papers separately and the third column must have the aggregate marks of the two. The candidate will be considered pass on the basis of the combined total marks secured in each paper.
- (8) For a pass, a student will have to obtain (a) at least 40% marks in each paper separately and (b) a minimum of 50% marks in the aggregate of all the papers prescribed for the examination. In the marksheet, successful candidates shall be classified as under:

Pass	50% or more but less than 55% marks in the aggregate
Second Division	55% or more but less than 65% marks in the aggregate
First Division	65% or more but less than 75% marks in the aggregate
First Division with Distinction	75% or more marks in the aggregate

A candidate who fails at the examination even in one paper/dissertation shall be required to reappear at the examination in a subsequent year in all the papers/dissertation prescribed for the examination, provided that a candidate who obtains at least 50% marks in dissertation shall be exempted from submitting a fresh dissertation and the marks obtained by him shall be carried forward for working out his result.

9. Depository with UGC

- (i) Following the successful completion of the evaluation process and announcements of the award of M.Phil the University shall submit a soft copy of the M.Phil dissertation obtained from the candidate to the UGC, for hosting the same in INFLIBNET accessible to all Institution/ Universities.
- (ii) Along with the Degree, the University, shall issue a Provisional Certificate certifying to the effect that the Degree has been awarded in accordance with the provisions to these Regulations of the UGC.

Semester I

PAPER-1 RESEARCH METHODOLOGY

- A. Research: Definition and type of research
 Problem : Identification and selection of problem
 Research Design: Meaning, definition and characteristics of research design.
- B. Writing of research proposal, Literature survey, methodology and data collection, sampling techniques, field questionnaire.
- C. Primary and secondary data , familiarity with ideas and concepts of investigation, acquiring technical skills, drawing inference from data, qualitative and quantitative analysis, assessing the problems.

PAPER-2 ADVANCE CONCEPTS IN INORGANIC CHEMISTRY

- A Solid State Chemistry and Structure : Imperfections and properties of solids such as ionic conductivity , diffusion . Ferroelectric properties, luminescence , optical and thermal excitation in solids , phosphorescence and laser properties of inorganic compounds . Methods of analyzing solid state dislocations, their mechanism and reactions , superconductivity due to imperfections in solids, n-type and p-type dopants with specific examples.
- B. Ceramics :Definition, basic concepts,classification based on reduction in porosity, traditional ceramics powder for engineering ceramics , additives and chemicals,waste materials and function of main raw materials in various ceramic body.
 Various types of machines used for production of ceramics such as ball mills, filter press, pug mill, jolly, jigger, toddle press, mechanical press, hydraulic press, iso-static press, spray,drier.
 Various casting methods:- Extrusion methods, press method, injection moulding, dry pressing, isostatic pressing, HIP, slip casting.
 Application of colours to pottery, applications of important ceramics.
- C. Polymers and Macromolecules: Nature of Macromolecule, force involved in high polymer interactions, methods for studying size and shapes of polymers by various experimental techniques, sedimentation, ultracentrifuge, viscosity, electrophoretic and diffraction methods,

configuration of polymer molecules, rubber, elasticity and crystallinity of polymer structure. Transition Helix Coil Transition, optical methods for studying transitions and ORD mechanism of coordination on catalytic compounds

PAPER-3 ADVANCED CONCEPTS IN ORGANIC CHEMISTRY

- A. Planning and designing of organic synthesis – A Retro synthetic approach :
 Selection of target molecules, Retro synthetic analysis – A disconnection of targets using various aspects like one group disconnection, two group disconnection, illogical two group disconnection, disconnection in heterocyclic compounds, disconnection in small ring compounds etc. Planning and designing of the synthesis using appropriate disconnection, use of umpolung of carbonyl reactivity, use of pericyclic reactions, use of ketenes, use of radical reactions etc. Protection and deprotection of various groups. Use of FGI and FGA in synthesis, use of Chiron approach in organic synthesis.
- B. Green chemistry:
 Introduction of green chemistry, atom economy, less hazardous chemical synthesis, designing safer chemicals, safer solvents and auxillaries, use of ionic liquids, design for energy efficiency, catalysis and analysis for pollution prevention.
- C. Combinatorial Chemistry:
 Introduction of Combinatorial Chemistry, library synthesis on resin beads, solid phases, solution phase library synthesis, peptide libraries, solid phase library chemistry and application of combinatorial chemistry.

PAPER- 4 DISSERTATION

Semester II

PAPER- 5 ADVANCE RESEARCH METHODOLOGY

- A. Confidence limits, statistical aids to hypothesis testing Type I and Type II errors, detection of gross errors, estimation of detection limits, the least square method for drawing calibration plot, quality assurance and control charts, significant figures statistical treatment of data, rejection of data, variance and standard deviation, data analysis, statistical use in chemistry research
- B. Report Writing: Types of manuscript, review, original manuscript, short communication, presenting a scientific seminar, publication of research paper. Basic principle and techniques to be adopted for writing a M.Phil dissertation and Ph.D. Thesis. ISSN No. ISBN No., Citation Index, Impact Factor of Journals
- C. Research Ethics and Plagiarism, types of reference style

PAPER-6 PHYSICAL CHEMISTRY AND SPECTROSCOPY

- A. Chemical Dynamics:
- Free Radical Reaction: Introduction, kinetics characteristics of free radical reactions. Derivation of steady state rate law, absolute reaction rate, kinetics and solvent effects.
- Induced Reaction: Definition, types of induced reactions, examples of induced reactions, induced reactions employing oxidants such as Cr (VI) and Mn (VII), mechanism of induced reactions.
- Fast Reactions: Introduction, difference between slow and fast reactions, experimental techniques for studying of fast reactions such as flow methods and relaxation methods and NMR techniques, flash photolysis.
- Jablonski diagram in photochemical reactions, relative times events.
 - Reaction of Single Molecular Oxygen: Introduction, discovery,

formation methods for detection, estimation and quenching, reaction of singlet molecular oxygen with organic compounds.

Voltammetry & Cyclic voltammetry, Anodic stripping voltammetry

B. Spectroscopy

Electron diffraction : Scattering of electrons by atoms, procedure of obtaining electron diffraction, analysis of results and applications.

Neutron diffraction : Scattering of slow neutrons by atoms, procedures for obtaining neutron diffraction, analysis of results and applications.

Mossbauer Spectroscopy: Introduction, quadrupole and magnetic interactions, application to Be and Sn Systems.

Photo acoustic Spectroscopy: Basic principle of photo acoustic spectroscopy (PAS), PAS gases & condensed systems, chemical & surface application.

Molecular Luminescence Spectroscopy:

Introduction to molecular luminescence (fluorescence, phosphorescence and chemiluminescence); theory of luminescence; instruments for measuring fluorescence (fluorometer and spectrofluorometer); application and problems.

Electron Spectroscopy:

Introduction to electron spectroscopy (ESCA Auger and UPS), principle and theory of ESCA, instrumentation, chemical shifts, satellite peaks and spectral splitting; application and problems.

Principle and electron transition of Auger electron spectroscopy, equipment, applications and problems.

C. Advanced Spectroscopy:

¹³C-NMR Spectroscopy: Difficulties and solution for recording ¹³C-NMR spectra, recording of ¹³C-NMR spectra – scale, solvents, solvent signals and their positions, multiplicity, ¹³C-¹H coupling constant – proton coupled and decoupled ¹³C spectra, broad band decoupling, off resonance technique. Chemical shifts in ¹³C spectra – chemical shift calculation for alkanes, alkenes and alkynes, chemical shift calculation in internal and terminal substituted compounds, aromatic compounds. Use of ¹³C spectra in differentiating stereoisomers, Nuclear Overhauser

Effect. ^{13}C - DEPT spectra – differentiation in primary, secondary and tertiary carbons by DEPT – 45, DEPT – 90, DEPT – 135 spectra.

2D NMR Spectroscopy: Theory and principles of 2D NMR spectroscopy, interpretation of ^1H - ^1H COSY, ^1H - ^{13}C HETCOR, HMQC, HMBC, INADEQUATE spectra.

Mass Spectroscopy: Theory and principles of mass spectroscopy, instrumentation, low and high resolution mass spectra, Ionization techniques – Electron Impact ionization, Chemical Ionization, Field Desorption, Fast Ion Bombardment, Electrospray Ionization and Matrix Assisted Laser Desorption/Ionization. Determination of molecular weight and molecular formula, nitrogen rule, detection of molecular ion peak, metastable ion peak. Fragmentations – rules governing the fragmentations, McLafferty rearrangement. Interpretation of mass spectra of different class of compounds – saturated and unsaturated hydrocarbons, aromatic hydrocarbons, alcohols, ethers, ketones, aldehydes, carboxylic acids, amines, amides, compounds containing halogens.

PAPER -7 CONCEPTS OF ANALYTICAL AND BIOLOGICAL CHEMISTRY

A. Physico Chemical Aspects of Air and Water Pollution

Air Pollution: Air quality standards, sampling and monitoring of air pollutants-gaseous and particulate, sources and effects of air pollution caused by carbon monoxide, oxide of nitrogen, sulphur dioxide, ozone, water vapours, aerosols and minor pollutant gases, indoor pollution, composition of atmosphere -Troposphere Stratosphere, Mesosphere and Thermosphere.

Water Pollution: Water quality parameters and standards, classification and sampling of water pollutants, sources of water pollution- solid waste, industrial, agricultural, oil, radioactive waste, thermal pollution. Instrumental techniques for analyzing metal pollutants in water.

B. Co-enzymes & Metal ions in Biological System

Role of bulk and trace elements in biological systems, micro-elements,

active transport of Na, Mg, and Ca across the biological membrane.

Iron storage and transport, copper proteins, metalloenzymes, general discussion of enzymes functions of metal ions, inhibition (Exploration based on coordination chemistry)

Vitamins B12 and B12 coenzymes

Hypnotics and Sedatives- Barbiturates & Phenobarbitone sodium

CNS Stimulant- Caffeine, ethamivan

C. Chromatographic Techniques

Theory, instrumentation and applications of:

(i) Gas Chromatography

(ii) High Performance Liquid Chromatography

PAPER- 8 DISSERTATION

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Books Recommended:

1. Designing Organic Synthesis – A Programmed introduction to the Synthon Approach Stuart Warren, John Wiley & Sons Ltd.
2. Organic Synthesis – The Disconnection Approach
Stuart Warren, John Wiley & Sons Ltd.
3. Green Chemistry : Theory and Practice
Paul. T. Anastas and John C. Warner
4. Combinatorial Chemistry
Nicholas K. Terrett
Oxford University Press Inc., New York
5. Photochemistry
Vol.32 by Senior Reporter A. Gilbert
The Royal Society of Chemistry, Thomas Graham House, Science Park,
Milton Road, Cambridge CB4 0WF, UK
6. Industrial Ceramics – F. Singer, S. Singer
7. Hand Book Of Ceramics – S. Kumar
8. Spectroscopic Identification of Organic Compounds
R.M. Silverstein and F.X. Webster, 6th edition
John Wiley & Sons
9. Introduction to Spectroscopy
D.L. Pavia, G.M. Lampman and G.S. Kriz, 3rd Edition
Thomas Brooks /Cole
10. Spectroscopic Methods in Organic Chemistry
D.H. Williams and I. Fleming, 4th edition
Mc. Graw Hill Book Company
11. Spectroscopy of Organic Compounds
P.S. Kalsi, 5th edition
New Age International Publishers
12. Principles of Instrumental Analysis
Skoog, Holler and Neiman
Sunders College Publishers (USA)
13. Introduction to Instrumental Analysis
Robert D. Braun
Pharme Med Press Hyderabad - India
14. Instrumental Method of Analysis
Williard, Merritt, Jr., Dean and Settle Jr.
CBS Publishers and Distributors, New Delhi, India