

***SCHEME OF EXAMINATIONS***

***AND***

***SYLLABUS***

***(for Academic Session 2019-2020)***

**Master of Philosophy (M.Phil.)  
Chemistry**

**Faculty of Science**



**UNIVERSITY OF KOTA**

**MBS Marg, KOTA (Rajasthan)-324 005**

**INDIA**

**Master of Philosophy**  
**(M.Phil.)**

**CHEMISTRY**

**SCHEME OF EXAMINATION**

**THEORY & INTERNAL ASSESSMENT**

<b>Course No.</b>		<b>Nomenclature of Paper</b>
Paper I	–	Advanced Concept in Inorganic Chemistry
Paper II	–	Organic Synthesis
Paper III	–	Physical Methods in Chemical Analysis

Each Paper will be of 100 maximum marks. Theory Paper will be of 80 marks and Internal Assessment of 20 marks on the basis of one seminar (presentation and discussion) in each paper. The duration of the Theory Papers is 3 hours each. Each question paper will contain 10 questions in all containing two questions from each unit. Students will be required to attempt 5 questions in all selecting one question from each unit.

**PROJECT WORK / DISSERTATION**

It will be based on the Project work undertaken by each candidate. Each candidate will have the different project work in the form of dissertation. The marks allotted for this project work are 100.

**Ordinance 123-V relating to Scheme of M.Phil. Examination**

1. The M.Phil. Course should be started/continued in a department when it has got at least three teachers who possess the qualification to supervise research towards the Ph.D. Degree.
2. The following minimum conditions should be ensured before permitting an affiliated college to start the M. Phil course:
  - (a) The college should have fulfilled all the conditions prescribed by the University for Affiliation for the post graduate course.
  - (b) The college must have been permanently affiliated with the University for running post graduate course in the subject in which it intends to start the M.Phil. course.
  - (c) There should be a staff of teachers out of whom at least three possess the qualification prescribed by the University to supervise research towards the Ph.D. Degree.
3. The general provisions of Statutes, Ordinance etc. in respect of admission of student to the examinations of the University including enrolment, discipline, Health & Residence as also for affiliation of colleges will apply for M.Phil. Course/ Examination unless otherwise specified hereunder.
4. The Course of study for the M.Phil., degree shall extend over a period of one academic year. There shall be a continuous internal assessment as well as an external assessment. The examination for external assessment shall be written and/or practical

- as may be prescribed by the Board of Management on the recommendation of the Academic Council from time to time.
5. Every candidate shall be required to offer three written papers and one dissertation (equivalent to one paper) within this framework, each teaching department of the University shall recommend the course of study for the M.Phil. Examination its own subject(s) which shall be placed before the concerned Board of Studies, Faculty, Academic Council and the Board of Management for approval.
  6. The number of candidates to be admitted to an M.Phil. course in any department each year shall be decided by the department itself but it shall not be less than 5 and more than 15 in Arts / Social Sciences, 10 in Commerce and 10 in Science. The actual number of students to be admitted in a session will depend on the availability of facilities in the Department concerned.
  7. A candidate for admission to the courses of study for the degree of M.Phil. must have obtained a master's degree with at least 55% marks in the post-graduate examination, a second division at the degree examination of the University/ or any other University/Institution recognized as equivalent there to, in to pursue the course.
  8. In service candidates shall not be eligible for admission to the M.Phil. course. However, teachers may be allowed to join the course but only after taking leave from their employer for the duration of the course provided they fulfill the minimum eligibility conditions for the course.
  9. The placement of every candidate under a Supervisor/guide shall be decided within two months from the date of admission.
  10. Every candidate shall be required to attend a minimum of 66% of the lecturers, tutorial, seminars and practical (taken together) held in each paper. A certificate to this effect in respect of every candidate by the Head of the department/ Institution concerned to the Registrar so as to reach him at least 15 days before the commencement of examination.
  11. Every candidate for admission to the examination shall submit the University an application in the prescribed form along with the prescribed examination and mark-sheet fee.
  12. All paper-setters and examiners for the external assessment shall be external persons (i.e. those who are not working either in the university or in any of its affiliated colleges). The Board of Studies shall prepare a separate panel of examiners for M.Phil. The University Department teaching M.Phil. classes shall suggested a panel of examiners for each paper and dissertation for consideration of the Board of Studies. Appointment of paper setters and examiners shall be made by the examiner's selection committees. If there is no representative from the University teachers on the department teaching M.Phil. for consultation with regard to appointment of paper-setters examiners for the M.Phil. examination in the subject concerned.
  13. Unless otherwise specified, candidates' will have the option to answer their question papers and write their dissertation in English or Hindi as permissible at the post-graduate examination of the University in the same subject.
  14. The M.Phil. Examinations will normally be held in the month of may each year and the last date of submission of dissertation will normally be 21 days prior to the commencement of the theory examinations. The internal assessment marks should be sent by various departments to the University office before the commencement of the theory papers. If the internal assessment marks of any candidate or from any department are not received before the commencement of the theory examination,

- marks in internal assessment in each paper be awarded to each candidate in proportion to the marks obtained by him in that particular paper in the external assessment.
15. The answer books and the dissertation of external examination shall be evaluated independently by two examiners and where the difference between the two awards exceeds 20% of the maximum marks allotted to the paper, the answer-book shall be evaluated by a third examiner. In the former case, the average of the two awards and in the later case, the average of the two nearest awards shall be taken into account.
  16. Each theory paper shall consist of 100 marks. The dissertation shall also consists of 100 marks, it also be assessed by two external examiners. For a pass, a candidate shall be required to obtain:
    - (a) At least 40% marks in each paper separately.
    - (b) A minimum of 50% marks in the aggregate of all the papers prescribed for the examination. In the marks sheet successful candidates shall be classified as under.
      - (a) First division with distinction, candidates obtaining 75% or more marks in the aggregate.
      - (b) First division candidates obtaining 65% or more but less than 75% marks in the aggregate.
      - (c) Second division. All the rest.
  17. Three periods of one hour each per week shall be provided for each theory paper and two periods for dissertation.
  18. The following minimum condition should be ensured before permitting an affiliated college to start M.Phil. Course:
    - (a) The college should have fulfilled all the conditions prescribed by the University for Affiliation for the post-graduate course.
    - (b) The college must have been permanently affiliated with the University for running post graduate course in the subject in which it intends to start the M.Phil. Course.
    - (c) There should be at least six-post-graduate teachers out of whom at least three should have already been recognized as Research Supervisors and possess at least ten years teaching experience of post graduate classes. The teachers should possess the minimum qualification prescribed by the University for the Post of Reader.
    - (d) There should be staff of 6 teachers out of whom at least three possess the qualification prescribed by the University to supervise research towards the Ph.D. Degree.
    - (e) The college will always maintain teaching staff for the M. Phil. Course as per University rules.
    - (f) The college should possess adequate reference books and research journals in the subject in which a college intends to start M.Phil. Course.

## **Master of Philosophy** **(M.Phil.)**

### **CHEMISTRY**

#### **Syllabus**

#### **PAPER-I : ADVANCED CONCEPTS IN INORGANIC CHEMISTRY**

**Duration of Examination: 3 Hours**

**Max. Marks: 80**

*Note: Questions paper will contain 10 questions i.e. two from each unit. Candidates shall be required to attempt five questions in all selecting one from each unit.*

#### **Unit-I Nano-materials:**

Introduction, definition and terminology consequences of the Nanoscale (Nanoparticle morphology, electronic structure, optical properties), one dimensional nano-materials (nanofilms, nanolayers), two dimensional nanomaterials (nanotubes, nanowires), three dimensional nanomaterials (nanoparticles: quantum dots). applications of nanomaterials (sensors, energy cell, catalysis, drug delivery systems).

#### **Unit-II Nature of Macromolecules:**

Forces involved in high polymers interaction methods for studying size and shapes of high polymers by various experimental techniques, sedimentation, ultracentrifuge. Viscosity, electrophoretic and diffraction methods, configuration of polymers, molecules rubber, elasticity and crystallinity compounds. Inorganic polymer and ring compound. Linear and cyclic borazenes, phosphazenes, thiazenes, phosphonitrilic polymers.

#### **Unit-III Silicates and Alumino-silicates:**

Micas, clays, feldspars, zeolites, ultramarines, modification of clays (Pillared clays), synthetic zeolites (ZSM-5 & ZSM-11), polymers based on silicon, silazanes, metal clusters, co-ordination and metal chelate polymers.

#### **Unit-IV**

Role of bulk and trace metals in biological system. microelements, 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 B<sub>12</sub> and B<sub>12</sub> coenzymes.

Principles of molecular association and organization as exemplified in biological macromolecules like enzymes, nucleic acid, membranes and model system like micelles and vesicles, molecular receptor and design principles, cryptand, cyclophanes, calixarenes, cyclodextrins, supramolecular reactivity and catalysis, molecular channels and transport process.

#### **Unit-V Air Pollution:**

General consideration, air pollution, type of pollution and unit of measurement. air quality standards. sampling and monitoring. sources and effects of air pollution caused by carbon monoxide. oxide of nitrogen, sulphur dioxide, ozone, water vapors. aerosols and minor pollutant gases, indoor pollution, composition of atmosphere, troposphere, stratosphere, mesosphere and thermosphere.

**Water Pollution:** Pollution cycle in environment, aquatic environment water pollutants, trace element in water, speciation with special reference to copper, lead, mercury and arsenic, water quality parameters and standards, sample presentation.

### **PAPER-II ORGANIC SYNTHESIS**

**Duration of Examination: 3 Hours**

**Max. Marks: 80**

*Note: Questions paper will contain 10 questions i.e. two from each unit. Candidates shall be required to attempt five questions in all selecting one from each unit.*

#### **Unit-I Organic Name Reactions:**

Baeyer-Villiger oxidation, Barton reaction, Diels-Alder reaction, Favorskii rearrangement, Fries rearrangement, Birch reduction, Chichibabin reaction, Clemmenson reduction, Mcerwein-Pondrof-Verley reduction, Oppenauer oxidation, Perkin reaction, Reformatsky reaction, Friedel-Crafts reaction, Stork enamine reaction, Mannich reaction, Reimer-Tieman reaction.

#### **Unit-II Reagents in Organic Synthesis:**

Sodium cyanoborohydride, osmium tetroxide, lithium dialkyl, thallium trifluoroacetate, sodium hydrotelluride, trichlorosilane, ruthenium tetroxide, benzenesulphonyl bromide / chloride, benzeneselenyl halides, phosphorusoxy chloride, barrium managanate-benzene selonic acid, aluminium chloride/phosphoryl chloride, organometallic compounds of Mg, Li, Rh and Ni, rearrangements of catalyzed by metal ion and complexes.

#### **Unit-III Oxidation:**

Oxidation of the following class of organic compound with transition metals particularly with Cr, Mn, V and Co: Alkanes, alcoholols, glycols, carbonyl compounds, carboxylic acids, amino acids, thio compounds, aromatic hydrocarbons.

#### **Reduction:**

Catalytic reduction, metal hydrides, dissolved metal, reduction of specific functional groups: alkenes, carbonyls, unsaturated carbonyls, reductive ring opening of epoxides, reduction of aromatic and heterocyclic compounds.

#### **Unit-IV Biosynthetic Pathway of Natural Products:**

Acetate hypothesis, poly-beta-ketoacids, their aldol type cyclization and meta-orientation of hydroxyl groups in naturally occurring phenols, biogenesis of muscone. Isoprene rule, mechanism of formation of mevalonic and from acetyl coenzyme-A, biogenic isoprene rule, generyl pyrophosphate and its conversion into  $\alpha$ -pinene, urazine and borneol. Farnesyl and geranyl-pyrophosphate and mechanistic consideration, their conversion into cadnonnes and abietic acid, Shikimik acid pathway.

**Unit -V Chemistry of following Chemotherapeutic Agents and their Mode of Action:**

- |                               |  |
|-------------------------------|--|
| (a) Antipyretics & Analgesics | – Phenacetin, Salicylic acid, Cinchophen |
| (b) Anesthetics               | – Procaine, Methohexital                 |
| (c) Hypnotics & Sedatives     | – Barbiturates & Phenobarbitone          |
| (d) CNS stimulants            | – Caffeine, Amphetamine.                 |

**PAPER-III: PHYSICAL METHODS IN CHEMICAL ANALYSIS**

**Duration of Examination: 3 Hours**

**Max. Marks: 80**

*Note: Questions paper will contain 10 questions i.e. two from each unit. Candidates shall be required to attempt five questions in all selecting one from each unit.*

**Unit-I Chemical Dynamics:**

**Free Radical Reaction:** Introduction, kinetic characteristics of reactions, Bodenstein steady state concept, derivation of rate law, absolute reaction rate, competition kinetics and solvent effects.

**Induced Reaction:** Definition, Types of induced reaction, Induced chain reactions examples of induced reaction with special reference to the oxidations by Cr(VI), Mn(VII) peroxydisulphate.

**Oscillatory Reaction:** Introduction, thermodynamic and chemical aspects of chemical oscillations, composition of thermodynamical criterion, homogeneous temporal oscillations, general mechanism for bromate driven oscillatory reactions.

**Fast Reaction:** Introduction, experimental techniques, stopped flow and relaxation methods, rate equilibrium, examples of rapid reactions.

**Unit-II Photo-chemical Processes:**

Jablonski diagram, relative times of events, reactions of singlet molecular oxygen: Introduction, discovery, formation, methods for detection, estimation and quenching, reaction of singlet molecular oxygen with organic compounds.

**Quantitative Data Statistics of Chemists:**

Data analysis normal and other distribution errors propagation, least square methods, correlation, regression equation, reproductivity variance estimates.

**Unit-III Basic Concepts & Instrumentation:**

**IR Spectroscopy:** Basic instrumentation, selection rule, normal modes of vibrations, factors affecting the bond positions and intensities, FT-IR spectroscopy.

**NMR Spectroscopy:** Nuclear spin, nuclear resonance, saturation, relaxation, shielding and deshielding of magnetic nuclei, coupling constant, chemical shift and its measurements, factors affecting chemical shift, spin-spin interactions and spin decoupling, introduction to  $^{13}\text{C}$ -NMR and FT-NMR spectroscopy.

**NQR Spectroscopy:** Effect of magnetic field on spectra, relationship between electrical field gradient and molecular structure, applications.

**Mössbauer Spectroscopy:** Introduction, quadrupole and magnetic interactions, applications to Fe and Sn systems.

**Unit-IV Chromatography:**

Basic concepts and instrumentation

- (a) Theory of chromatography
- (b) Sample injection, sampling system for capillary column and packed columns.

- (c) Detectors
- (d) Gas Chromatography
- (e) H.P.L.C.
- (f) Applications of different chromatographic techniques.

**Unit-V Electron Diffraction:**

Scattering of electron 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.

**Electron Microscopy:**

Theory, instrumentation and application of SEM, TEM and AFM.

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