

SESSION-2022-23



**Maharaja Surajmal Brij University**

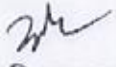
**Bharatpur (Raj.)**

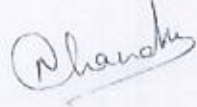
**ORDINANCES AND SYLLABUS OF**


**M.Sc. CHEMISTRY**

**Based on Choice Based Credit System (CBCS)**

**(with effect from Session 2020-21)**

  
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महाराजा सूरजमल बृज विश्वविद्यालय  
भरतपुर (राज.)

  
(Dr. Nisha Chandra)

  
अकादमिक प्रभारी  
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SESSION-2022-23

Session 2021-2022 & Onwards

**INORGANIC CHEMISTRY** [60]

**(A) Qualitative and Quantitative Analysis:** [30]

(i) Separation and determination of two metal ions Cu-Ni, Ni-Zn, Cu-Zn, etc. involving volumetric and gravimetric methods.

**(B) Inorganic Preparations: (Any Four)** [30]

- (i) Reineckel Salt
- (ii) Tetraamine Cupric Sulphate
- (iii) Chrome Alum
- (iv) Aluminium Chloride Hexahydrate
- (v) Nickel Dimethyl Glyoxime
- (vi) Sodium Cobalt Nitrate
- (vii) Potassium Trioxalato Ferrate
- (viii) *Cis*-Potassium Dioxalato Diaqua Chromate
- (ix) *Trans*-Potassium Dioxalato Diaqua Chromate  
 $K[Cr(C_2O_4)(H_2O)_2] \cdot 2H_2O$
- (x) Prussian Blue

**ORGANIC CHEMISTRY** [70]

**(A) Qualitative Analysis:** [50]

Separation, Purification and Identification of compounds of tertiary mixtures (three solids)

**(B) Organic Synthesis:** [20]

Sulphonation, Diazotization, Acetylation, Benzoylation, Nitration.

**PHYSICAL CHEMISTRY (Any Four)** [70]

- (1) To estimate hardness of water by ethylene diamine tetra-acetic acid (EDTA).
- (2) To study the distribution co-efficient of benzoic acid between benzene and water.
- (3) To determine the distribution co-efficient of iodine between water and  $CCl_4$  at room temperature.
- (4) To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
- (5) To titrate the given mixture of  $CO_3$  and  $HCO_3$  ions against a strong acid (HCl) using p-meter and to determine the strength of it.
- (6) To determine the amount of chloride ions present in the given KCl solution.

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SESSION-2022-23

- (7) To determine nickel as dimethyl glyoximate complex spectrophotometrically.
- (8) Preparation of standard solution
- (9) Determination of proton coefficient between water and an organic solvent.
- (10) To test the validity of Lambert-Beer's Law (using methylene blue) and to determine

I.  $\lambda_{max}$

II. Molar extinction coefficient ( $\epsilon$ )

RECORD [10]

SYNOPSIS [10]

VIVA [10]

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Session 2021-2022 & Onwards

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M.Sc. Chemistry Practical (Final Year) III &amp; IV Sem.

[M.M. 200]

## ORGANIC CHEMISTRY

1. **Extraction of Organic compounds from natural resources: (One exercise)** [40]
  - (i) Isolation of lactose from milk.
  - (ii) Isolation of casein from milk.
  - (iii) Isolation of caffeine from tea leaves.
  - (iv) Isolation of  $\beta$ -carotene from carrot.
  - (v) Isolation of lycopene from tomatoes.
  - (vi) Isolation of cystine from human hair.
  - (vii) Isolation of Nicotine from tobacco.
2. **Multi-step synthesis of organic compounds: (One exercise)** [30]
  - (i) Preparation of p-Bromoaniline from Aniline (Bromination)
  - (ii) Preparation of p-nitroaniline from Aniline (Nitration)
  - (iii) Preparation of quinoline from aniline (Skraup Synthesis)
  - (iv) Preparation of 2-phenyl indole from phenyl hydrazine (Fischer-Indole synthesis)
  - (v) Benzoyl chloride to Benzaniline (Benzoylation)
  - (vi) Benzene to Acetanilide (Acetylation)
3. **Green chemistry: (One exercise)** [30]
  - (i) Coenzyme catalysed benzoin condensation (Thiamine hydrolysed catalysed synthesis of benzene)
  - (ii) Electrophilic aromatic substitution reaction-1 (Nitration of Phenol)
  - (iii) Radical coupling reaction (Preparation of 1,1-Bis-2-naphthol)
  - (iv) Three component coupling (Synthesis of dihydropyrimidinone)
  - (v) Transesterification reaction (Synthesis of biodies)
  - (vi) Preparation of Iron (III) acetylacetonate
4. **Paper chromatography, separation and Identification of sugars present in glucose, fructose, sucrose by paper chromatography and determination of Rf values/TLC.** [30]
5. **Spectrophotometric estimation/Identification: (One exercise)** [30]
  - (i) Aspirin, disprin, Sprintas
  - (ii) Caffeine

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SESSION-2022-23

- (iii) Ascorbic Acid (Lemon, Amla)  
(iv) Carbohydrate (Glucose, Sucrose, Fructose)  
(v) Amino acids

RECORD [10]

SYNOPSIS [10]

VIVA [10]

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DEPARTMENT OF CHEMISTRY (w.e.f. 2020-21 session onwards)  
Course Offered at Post-Graduate level (M.Sc. Chemistry) based on CBCS system

Core Course I-SEMESTER	Course Title	Marks			Total	Credits
		Test	Assignment	End Sem Exam		
C-1	COMPUTER FOR CHEMISTS	20	20	50	100	4
C-2	INORGANIC CHEMISTRY	20	20	60	100	4
C-3	ORGANIC CHEMISTRY	20	20	60	100	4
C-4	PHYSICAL CHEMISTRY SEMINAR	20	20	60	100	4
II-SEMESTER						
C-5	GROUP THEORY AND SPECTROSCOPY	20	20	60	100	4
C-6	BIO- INORGANIC CHEMISTRY	20	20	60	100	4
C-7	BIO-PHYSICAL CHEMISTRY	20	20	60	100	4
C-8	SPECTROSCOPIC METHODS OF ANALYSIS SEMINAR	20	20	60	100	4
III-SEMESTER						
C-9	PHOTO AND STEREOCHEMISTRY	20	20	60	100	4
C-10	SOLID STATE CHEMISTRY, SURFACE PHENOMENON AND CHEMICAL EQUILIBRIA	20	20	60	100	4
C-11	COORDINATION CHEMISTRY	20	20	60	100	4
C-12	SOFT ELECTIVE-I	20	20	60	100	4
O-1	OPEN ELECTIVE-1 Seminar	10	10	30	50	2
IV-SEMESTER						
C-13	INTERDISCIPLINARY TOPICS	20	20	60	100	4
C-14	CHEMISTRY OF NATURAL PRODUCTS	20	20	60	100	4
C-15	ADVANCED ORGANIC CHEMISTRY	20	20	60	100	4
C-16	SOFT ELECTIVE-II	20	20	60	100	4
O-2	OPEN ELECTIVE-II SEMINAR	10	10	30	50	2
PRACTICAL					200	8
GRAND TOTAL					2300	Credit 92

Soft Electives: (1) Basic Analytical Chemistry (2) Advanced Analytical chemistry  
Open Electives: (1) Advanced computer for chemists (2) Research Methodology

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DEPARTMENT OF CHEMISTRY

Ordinance of M.Sc. Chemistry (w.e.f.-2020-21 session onwards)

1. The title of M.Sc. course shall be M.Sc. Degree in Chemistry and it will run in the Department of Chemistry, Maharaja Surajmal Brij University, Bharatpur.
2. The M.Sc. Chemistry course shall be of two years and four semesters and based on Choice Based Credit System (CBCS). The first year of M.Sc. will be known as M.Sc. (P) having I and II semesters. Similarly, second year of this course shall be called M.Sc. (F) having III and IV semesters.
3. For each semester, there shall be four theory papers in which one paper will be of MCQ based.
  - a) There will be one seminar in each semester, besides some tests (these are given in course structure/syllabus).
4. The seminars shall be conducted by the teachers concerned and Head of the based Department and seminar will be of 50 marks.
5. At the end of each semester, there shall be a term examination of three hours duration for each paper. There shall be four papers in each semester.
6. Absentees in test will be awarded zero marks.
7. Prior to the commencement of each term examination, there shall be preparation leave of one week (7 days).
8. The examination shall be conducted by the board of the external and internal examiners and Head of the Department who shall be the Chairman of the Board.
9. On the evaluation of the answer books of the each semester test examination, the examiner concerned will keep the answer books in his custody for one week from the date of the test and the examinees will have an access to their answer books during this period.
10. At the end of II<sup>nd</sup> semester there shall be practical examination of 200 marks for passing M.Sc. (P). Similarly, after IV semesters there shall again a practical examination of 200 marks for passing M.Sc. (F). Each practical examination shall be of 18 hours spread over to two days. If a candidate fails to appear in any of the aforesaid practical examinations, a special practical examination can be conducted for the candidate on the deposition of Rs. 1500.00 (One thousand five hundred only) or as per University guidelines as a special practical examination fee.
11. For each practical examination, there shall be a board of two examiners, consisting one examiner from outside and one from the internal teachers. The external examiner shall be appointed by the Vice-chancellor on the recommendation of the Head of the department. The internal teacher will act as the Chairman of board of examiners and will fix up the dates in consultation with the Head of the department and external examiner.

Session 2021-2022 & Onwards

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SESSION-2022-23

12. The medium of teaching shall be only English and the question paper will be also set in English language only.
13. The minimum eligibility for admission to M.Sc. Chemistry course shall be :
  - a) B.Sc. (three years) degree with chemistry as one of the main subjects securing at least 55% of marks in aggregate or as per RPSC Norms
  - b) The selection of the candidates will be done on the basis of their written tests (100 marks) organized by the University merit.
  - c) Provide further that the above mentioned qualifications may be relaxed by the admitting authority in case of a confirmed teacher of any degree college.
14. A candidate who are admitted to M.Sc. Chemistry course, shall be required to:
  - a) Attend at least 75% of lectures, seminars and practical classes.
  - b) Appear in all tests and must deliver all seminars.
  - c) Appear in all the semester examinations.
15. For the successful students, division shall be awarded on the combined results of all four semesters examinations which shall be as follows :
  - a) First division: - Candidate securing 60% and above in aggregate of all the four semesters examinations.
  - b) Second division:- Candidate securing below 60% but not less 48% in aggregate of all the four semesters examinations.
  - c) Third division: - Candidate securing below 48% but not less 36% in aggregate of all the four semesters examinations.
  - d) Minimum passing marks shall be 36%.
16. A student who fails or want to improve in theory paper/(s) shall be given only one chance to reappear in that paper along with the next following examination according to the syllabus then in force at the time of reappearing. The chance to reappear shall be given only in three theory papers in one semester. The candidate shall, however, be promoted to the next semester.
17. A student may appear as an Ex-student in the term examination provided that :
  - a) He has completed all the semester examinations, tests and seminars but failed in aggregate of all the semester examinations.
  - b) He has attended 50% of lectures, practical, appeared in tests and seminars and he has submitted the Medical Certificate an application on the first day of term examination or prior to this.
18. The total marks assigned for this course shall be 2300 and the credit earn will be of 92 credit points.

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SESSION-2022-23

C-I: COMPUTERS FOR CHEMISTS (MCQ BASED) M.M. 60

Unit-I: History of development of computer, mainframe , mini, micro and super computers, generations of computers, general awareness of computer hardware- CPU and other peripheral devices, I/O and auxiliary storage devices.

Unit-II: Computer languages – development and history, operating system – single and multi uses system.

Unit-III: General awareness of popular commercial software packages like( DBASE, WORDSTAR) FOXPRO, MS-Excel, MS-Word, MS Power Point..

Unit-IV: Uses of computers in Chemistry

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SESSION-2022-23

C-2

INORGANIC CHEMISTRY

M.M. 60

**Unit I: Mechanism of inorganic reactions:**

Mechanisms of redox reactions of metal complexes, Substitution reactions of octahedral and square planar complexes in aqueous solutions, cis- and trans effects.

**Unit II: Nuclear Chemistry:**

Radioactive decay and equilibrium, Nuclear reactions and its types, Q-value, cross section of reactions, chemical effects of nuclear transformation. Nuclear fission-Fission products, Fission Yield and Nuclear Reactors, Nuclear Fusion and Stellar energy.

**Unit III: Metal clusters:**

Higher boranes, carboranes, metallocboranes, metallocarboranes, metal carbonyl and halide clusters. Compounds with metal-metal multiple bonds, Wade's rule, LNCC & HNCC, Capping rule.

**Unit IV: Chemistry of macrocycles:** Complexes of crown ethers, porphyrins and cryptands, their synthesis, important characteristics with special reference to hole size and importance in biological systems.

Session 2021-2022 & Onwards

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*31*  
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C-3

## ORGANIC CHEMISTRY

M.M.60

**Unit-I:** (a) Delocalized chemical bonding - conjugation, cross conjugation, resonance, hyperconjugation, tautomerism.

**Unit-II:** **Substitution reactions:**

$SN^1$ ,  $SN^2$ ,  $SN^{li}$  and  $SN^{2i}$  mechanisms, neighbouring group participation in aliphatic nucleophilic substitutions, Electrophilic and nucleophilic aromatic substitutions reactions.

**Unit-III:** **Elimination reactions:**

The  $E^1$ ,  $E^2$ ,  $E^1CB$  mechanisms, orientation in  $E^2$  reactions (Saytzeff and Hoffman), Pyrolytic syn-elimination, Stereochemistry of elimination reaction.

**Unit-IV:** **Reagents in Organic Synthesis:**

Lithium aluminium hydride, Sodium borohydride, lithium dialkylcuprate, lithium di-isopropylamine, Grignard reagents, mono & dialkylboranes, 1,3Dithiane, Gerard's reagent P & T, dicyclohexylcarbodiimide, N-bromosuccinimide.

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Session 2021-2022 & Onwards

**Unit-I: Statistical thermodynamics:**

- Chemical equilibria and equilibrium constant in terms of partition function, Fermi-Dirac statistics, Distribution law and application of formal, Bose-Einstein statistics-distribution law and application to helium.

**Unit-II: Chemical Dynamics:** Methods of determining rate laws, collision theory of reaction rates, steric factor, activated complex theory, Arrhenius equation and the activated complex theory, ionic reaction, kinetic salt effects, steady state kinetics, kinetics and thermodynamic control of reaction, treatment of unimolecular reactions treatment of unimolecular reactions. Dynamic chain (hydrogen-bromine reaction, pyrolysis of acetaldehyde decomposition of ethane, Photochemical (hydrogen-bromine and hydrogen-chlorine reactions)**Unit-III: Micelle:** Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factor-affecting the CMC of surfactants.**Unit-IV: Electrochemistry:** Electrochemistry of solution, Debye-Huckel-Onsager treatment and its extension, ion solvent interaction, Debye-Huckel-Jerum mode, thermodynamic of electrified interface equation, over potential, exchange current density.

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SESSION-2022-23

II-SEMESTER

C-5

GROUP THEORY AND SPECTROSCOPY

M.M.60

- Unit-I:** Symmetry elements and symmetry operation, point groups and their classification with examples, sub groups. General methods of assigning point groups to a molecules like water ( $C_{2v}$ ), ammonia ( $C_{3v}$ ).
- Unit-II:** • Rotational and vibrational spectroscopy: Introduction, fundamental principle and applications
- Unit-III:** Atomic absorption spectroscopy: Introduction, Principle instrumentation and applications
- Unit-IV:** Flame photometry: Introduction, principle, technique, instrumentation, interference and applications

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Session 2021-2022 & Onwards

**Unit-I: Metal ions in biology:**

Molecular mechanism of ion transport across membranes sodium and potassium pump, Essential and trace elements.

**Unit-II: Biomolecules:**

Structures and functions of metalloproteins in electron transport process - cytochromes and Iron-Sulphur proteins, DNA polymerisation, glucose storage.

**Unit-III: Bio-inorganic pigments:**

Chlorophyll, Photosystem-I and Photosystem-II in cleavage of water, haemoglobin, myoglobin, haemocyanin and hemerythrin.

**Unit-IV: Bio-Chemistry:**

Biochemistry of calcium, copper and zinc. Biological Nitrogen fixation (Associative nitrogen fixation, symbiotic nitrogen fixation).

**Unit-V: Toxicity of metals (cadmium, mercury, lead, arsenic, copper). Deficiency of Metal ions**

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C-7

## BIO-PHYSICAL CHEMISTRY

M.M.60

**Unit-I: Enzymes:**

Introduction, nomenclature and classification, Fischer lock and key; Koshland and Induced hypothesis; Transition state theory, acid base catalysis; Nucleophilic displacement on phosphorous atom. Multiple displacement reaction and the coupling of ATP, cleavage to endergonic processes.

**Unit-II: Coenzymes:**

Apoenzymes, structure and biological function of coenzymes, production, purification of enzymes, methods of immobilization of enzyme activity, application of immobilized enzymes, clinical use of enzymes

**Unit-III: Bio-energetics:**

Standard and free energy change in biochemical reactions, exergonic endergonic, hydrolysis of ATP, synthesis of ATP from ADP

**Unit-IV: Cell membranes and Transport of ions:**

Structure and functions of cell membrane, ion transport through cell membrane, irreversible thermodynamics treatment of membrane transport, nerve conduction.

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SESSION-2022-23

C-8 SPECTROSCOPIC METHODS OF ANALYSIS (MCQ) M.M.60

**Unit I: Ultraviolet and visible spectroscopy:**  
 Various electronic transitions, Beer-lambert law, effect of solvent on electronic transition, ultraviolet bands for various electronic transition, Woodward-Fieser rules for conjugation dienes and carbonyl compounds. Applications of UV visible spectroscopy with special reference to qualitative analysis, quantitative analysis detection of impurities, simultaneous multicomponent analysis, distinction between cis and trans isomer.

**Unit II: Infra-red spectroscopy:**  
 Introduction, principle, fundamental vibration in polyatomic molecules, characteristic vibrational frequencies of alkanes, alkene, alkynes, aromatic compounds, alcohols, ethers phenols and amines. Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides, acids, anhydride, lactones, lactams, and conjugated carbonyl compounds.) and metal complexes. Hydrogen bonding and solvent effect on vibrational frequencies, overtones, combination bands and fermi resonances.

**Unit III: Nuclear magnetic resonance spectroscopy (NMR):**  
 Introduction, Theory, relaxation process and saturation, environmental effects on NMR spectra, chemical shift, spin-spin splitting, coupling constant, applications.

**Unit IV: Mass:**  
 Introduction, molecule ion peak, base peak, isotopic abundance, metastable ions fragmentation mechanism of compounds containing C,H,O,N and halogen, McLafferty rearrangement, nitrogen rule and ring rule and applications.

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## III-SEMESTER

C-9

## PHOTO AND STEREOCHEMISTRY

M.M.60

- Unit-I:** General principles- Photochemical energy, Frank-Condon principle, Jablonski diagram, singlet and triplet states, photosensitization, quenching, quantum efficiency and quantum yield, energy transfer process in photochemistry, experimental methods of photochemistry.
- Unit-II:** Photochemistry of carbonyl compounds, Norrish type-I and Norrish type-II cleavages, Paterno-Buchi reactions, photoreductions, photochemistry of unsaturated systems like olefins, cis-trans isomerisation, dimerizations, hydrogen abstraction, addition. Photochemistry of enones-rearrangement of unsaturated ketones and cyclohexadienones.
- Unit-III:** Concept of chirality, elements of symmetry, R-S nomenclature, E-Z isomerisms. Interconversion of Fischer, Newman and Sawhorse projections
- B) Conformation and reactivity in acyclic compound (upto four C-atoms) and cycloalkanes (upto cyclohexane)
- C) Transannular effects in medium sized ring compounds.
- Unit-IV:** A) Racemates and their classification, method of resolution of racemates.
- B) Chemoselectivity, regioselectivity, stereoselective, stereospecific reactions and enantioselectivity with examples.

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SESSION-2022-23

C-10 SOLID STATE CHEMISTRY, SURFACE PHENOMENON AND CHEMICAL EQUILIBRIA. M.M.60

Unit-I: Solid state: Crystalline state of solids, unit cells and Bravais lattices, Miller indices, Diffraction of X-rays by crystalline solids, fundamental aspects of Xray, electron and neutron diffraction studies

Unit-II: Crystal Defects and Non- Stoichiometry, Perfect and imperfect crystals, intrinsic and extrinsic defects-point defects, line and plane defects, vacancies Schottky defects and frenkel defects, structural imperfections and properties of solids such as ionic conductivity, diffusion, ferroelectric properties and luminescence, non-stoichiometry and defects.

Unit-III: Electronic properties and Band theory Metals, insulators and semiconductors, electronic structure of solids-band theory, band structure of metals, insulators and semiconductors, intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, superconductors,

Unit-IV: Surface Phenomenon Surface tension, adsorption on solids, electrical phenomena at interfaces, including electrokinetic, micelles and reverse micelles: solubilization, microemulsion, application of photoelectron spectroscopy, ESCA and Auger spectroscopy to the study of surfaces.

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C-11

COORDINATION CHEMISTRY (MCQ)

M.M.60

**Unit I:** Crystal field theory, crystal field splitting of d-orbitals in octahedral, tetrahedral and square planar complexes, crystal field stabilization energy (CFSE) in octahedral (weak and strong fields) and tetrahedral complexes, factor affecting CFSE and uses of CFSE, spectrochemical series.

**Unit-II:** (a) Applications of CFT in colour of transition metal complexes, limitations of CFT, valence bond theory and comparison of VBT and CFT.

(b) Ligand field theory, evidences of covalance and adjusted crystal field theory (ACFT), molecular orbital treatment of octahedral complexes and bonding, molecular orbitals for tetrahedral and square planar complexes, spin cross over coordination compounds.

**Unit III:** Coordination chemistry of transition metal ions, stability constants of complexes and their determination; stabilization of unusual oxidation states. Stereochemistry of coordination compounds. Jahn-Teller effect; Interpretation of electronic spectra including charge transfer spectra; nephelauxetic series, magnetism: Dia-, para-, ferro- and anti-ferromagnetism quenching of orbital angular moment, spin orbit coupling.

**Unit-IV:** Inorganic reaction mechanism; substitution reactions, trans effect and electron transfer reactions

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SESSION-2022-23

C-12

BASIC ANALYTICAL CHEMISTRY


M.M.60

- Unit-I:** **Conductometry:** Introduction, principle, technique, electrolytic conductivity, measurement of electrolytic conductivity, conductometric titration, applications.
- Unit-II:** **Polarography and Voltammetry:** (a) Introduction, principle, technique, D.M.E., half-wave potential, residual current, migration current, diffusion current, limiting current, applications.  
(b) Cyclic voltammetry and anodic stripping voltammetry.
- Unit-III:** **Amperometry:** Introduction, principle, types of current, technique, amperometric titrations with DME, amperometric titrations with rotating platinum micro electrode, biamperometry, applications.
- Unit-IV:** **Thermal methods of analysis:** TGA and DTA (principle, instrumentation, factors affecting TGA results, applications), a brief idea of DSC.

  
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## IV- SEMESTER

C-13

INTERDISCIPLINARY TOPICS (MCQ)

M.M.60

**Unit I: Chemistry in nanoscience and technology**

Introduction to nanotechnology, scope of applications, techniques for synthesis of nano particles, important nano materials (Nano optics, Nano magnetic, Nano electronics) carbon nanotubes (types, properties and applications)

**Unit II: Catalysis and Green Chemistry:**

Introduction to green chemistry, principles of green chemistry, designing and chemical synthesis, examples of green synthesis / reactions, future trends in green chemistry.

**Unit III: Environment and Atmosphere :**

Environmental chemistry, chemical composition of atmosphere – particles, ions and radicals and their formation. Heat budget of the earth atmospheric system, vertical stability of atmosphere, chemical and photochemical reactions in atmosphere, smog formation, oxides of N, C, S, O and their effect, green house effect, acid rain, air pollution controls and their chemistry.

**Unit IV: Environmental chemistry (Hydrosphere and soils):**

Aquatic pollution – inorganic, organic, pesticide, agricultural, industrial and sewage, detergents, oil spills and oil pollutants, water quality parameters, water quality standards, purification and treatments of waste. Soil composition, micro and macro nutrients, pollution – fertilizers and pesticides, waste treatment.

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C-14

CHEMISTRY OF NATURAL PRODUCTS

M.M.60

**Unit-I: Plant Pigments:**

Introduction, occurrence, general methods of structure determination, isolation and synthesis of apigenin, luteolin, vitexin,

**Unit-II: Alkaloids:**

Introduction, classification, occurrence, isolation of alkaloids, general methods of determination of structure of alkaloids, Constitution and synthesis of cocaine, nicotine, atropine, morphine,

**Unit-III: Terpenoids and Carotenoids:**

Introduction, classification, occurrence, general methods of structure determination, isoprene rule, constitution and synthesis of citral, zingiberene, farnesol, bisabolene,  $\beta$ -carotenoids, Biosynthesis of terpene.

**Unit-IV: Steroids:**

Introduction, classification, occurrence, isolation, constitution and synthesis of cholesterol, testosterone, progesterone, androsterone. Biosynthesis of steroid.

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**Unit I: Heterocycles:**

Introduction, classifications, IUPAC names of mono and bicyclic hetero aromatic compounds. Criteria of aromaticity in heterocycles. Synthesis and reaction of benzo [b] and benzo [c], benzodiazoles and acridines, pyrazole, imidazole oxazole, thiazole, indole, pyrimidine.

**Unit II: Common Organic Rearrangements and their mechanism:**

Pinacol- Pinacolone, Wagner- Meerwein, Demjanove Beckmann, Hoffmann, Curtius, Schmidt, Lossen, Sommelet-Hauser, Favoroskij and Baeyer- Villiger rearrangement.

**Unit III: Pericyclic reactions:**

Classification and examples, Woodward-Hofmann's Rule, Electrocyclic reaction, Cycloaddition reaction ([2+2] and [4+2] only) and Sigmatropic shifts [1,3]- shift, [1,5]-shift and [3,3]- shift (Cope rearrangement and Claisen rearrangement), FMO approach only.

**Unit IV: Dyes**

Colour and constitution, modern theories, detailed studies of indigo and alizarin. Dispersed Blue, Congo Red, Malachite Green, Methylene Blue.

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C-16

## ADVANCED ANALYTICAL METHODS

M.M.60

- Unit I:** Data Analysis: Errors, classification of errors, mean deviation and standard deviation, accuracy precision, rejection of measurements, confidence interval tests significance, error curve, minimization of errors, significant figures and computation of results, certified reference material and standard reference material.
- Unit II:** Principle, Instrumentation, Applications of X-Ray Diffraction (XRD)
- Unit III:** Principle, Instrumentation, Applications of Gas Chromatography-Mass Spectrometer, High Performance Liquid Chromatography (HPLC)
- Unit IV:** Principle, Instrumentation, Applications of Transmission Electron Microscopy (TEM) Scanning Electron Microscopy (SEM).

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SESSION-2022-23

O-1

COMPUTER APPLICATIONS

(Advanced Computer For Chemists)

M.M. 30  
~~M.M. 60~~

- Unit I:** History of Development of computer, Classification of computers, Generation of Computers, General awareness of computer hardware-CPU and other peripheral devices, input/output and auxiliary storage devices, Computer language and operating system.
- Unit II:** **Computer and Internet 1:** Desktop computers, Desktop workstation, client server, parallel and supercomputing, Application software Networking, different LAN and WAN connections, connecting to a network. Network components: UTP, Optical fibres, Ethernet, Network interface card, Hub, Routers, modems and requirements of Wi-Fi.
- Unit III:** **Computer and Internet 2 :** Internet based services, Internet service providers, Internet security, Web search engine, Net surfing using advanced search techniques, Building an intranet.
- Unit-IV:** Data Analysis and Display: MS- Excel, Facilities in MS Excel for Data Analysis and display, Preliminary introduction to Software for Scientific and Statistical analysis (e.g. SPSS, Origin), Creating a database and simple Querying, Adobe Photoshop (Introductory), Multimedia, Digital Arts.

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O-2

RESEARCH METHODOLOGY

M.M.60

Unit 1: INTRODUCTION TO RESEARCH METHODOLOGY

Research Methodology, Meaning of Research, Scientific Thinking, Research Fundamentals and Terminology, Objectives of Research, Types of research, Significance of research, selection of Institute, selection of research supervisor, Major research centres in India. Ranking Institutions (Criteria & Selection Procedure), Problems encountered by researchers in India.

Unit II: DEFINING THE RESEARCH PROBLEMS

What is research problem, Selecting the problem, Technique involved in defining a problem with illustrations, Formulation of hypothesis, Meaning and need for Research Design, Basic principles of Experimental design.

Unit III: SCIENCE AND ETHICS

Intellectual property and Intellectual property rights, Indian patent system, Research agreement. Ethics in science.

Unit-IV: GENERAL SAFETY

Basic Principles, basic laboratory procedures, Health and Safety, General safety and operational rules, safety of equipments, Personal protective equipment, and safety practices for disposal of broken glassware.

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