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M.Sc.
SEMESTER IPaper-I
MCH-401: INORGANIC CHEMISTRY I

M.M. 4240

Unit-I

Stereochemistry and Bonding in Main Group Compounds :
VSEPR, Walsh diagram (triatomic and penta-atomic molecules), d_{sp^2} bond, Bent rule,
and energetics of hybridization, some simple reactions of covalently bonded molecules.

Unit-II

Metal-Ligand Equilibrium in Solution

Stepwise and overall formation constants and their interaction, trends in stepwise constant, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand. Chelate effect and its thermodynamic origin, determination of binary formation constants by potentiometry and spectrophotometry.

Unit-III

Reaction Mechanism of Transition Metal Complexes

Energy profile of a reaction, reactivity of metal complex, inert and labile complexes, kinetic application of valence bond and crystal field theories, kinetics of octahedral substitution, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism, anion reactions, reactions without metal ligand bond cleavage. Substitution reactions in square planar complexes, the trans effect, mechanism of the substitution reaction. Redox reaction, electron transfer reactions, mechanism of one electron transfer reactions, outer sphere type reactions, cross reactions and Marcus-Hush theory, inner sphere type reactions.

Unit-IV

Metal-Ligand bonding

Concepts of ACFT/LFT;

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

Unit-V

HSAB Theory : Classification of acids and bases as hard and soft; HSAB principle, theoretical basis of hardness and softness, Lewis-acid base reactivity approximation, donor and acceptor numbers, E and C equation, applications of HSAB concept.

Books Suggested :

1. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley,
2. Inorganic Chemistry, J.E. Huhey, Harper & Row.
3. Chemistry of the Elements H.N. Greenwood and A. Earnshaw, Pergamon.
4. Inorganic Electronic Spectroscopy, A.H.P. Lever, Elsevier.
5. Magnetochemistry, R. I. Collin, Springer Verlag.
6. Comprehensive Coordination Chemistry eds. J. Wilkinson, R.D. Gillies and J.A. Mc Cleverty, Pergamon.

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M.Sc. Semester-I

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Paper-II
MCH-402: ORGANIC CHEMISTRY I

M.M. 42 40

Unit-I

The Nature of Bonding in Organic Molecules

Localized chemical bonding-conjugation, cross conjugation, resonance
conjugation, bonding in fullerenes, tautomerism. Aromaticity in benzenoid and
benzoid compounds, alternate and non-alternate hydrocarbons. Huckel's rule, energy
of π -molecular orbitals, annulenes, anti-aromaticity, homo-aromaticity, PMO
approach. Bonds weaker than covalent-addition compounds, crown ether complexes and
cands, inclusion compounds, catenanes and rotaxanes.

Unit-II

Stereochemistry

Strain due to unavoidable crowding Elements of symmetry, chirality, molecules with
more than one chiral center, threo and erythro isomers, methods of resolution, optical
activity, enantiotopic and diastereotopic atoms, groups and faces, stereospecific and
regioselective synthesis, Asymmetric synthesis. Optical activity in the absence of chiral
center (biphenyls, allenes and spirane chirality due to helical shape. Stereochemistry of
compounds containing nitrogen, sulphur and phosphorus.

Unit III

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Conformational analysis and linear free energy relationship
Conformational analysis of cycloalkanes, decalines, effect of conformation on reactivity,
Conformation of sugars.

Generation, structure, stability and reactivity of carbocations, carbanions, free radicals,
nitrenes and nitrenes. The Hammett equation and linear free energy relationship,
substituents and reaction constants, Taft equation.

Supervisor
Ramesh
2/9/20

Unit-IV

Reaction Mechanism : Structure and Reactivity

Types of mechanisms, types of reactions, thermodynamic and kinetic requirements,
kinetic and thermodynamic control, Hammond's postulate, Curtin-Hammett principle.
Potential energy diagrams, transition states and intermediates, methods of determining
mechanisms, isotope effects

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Unit-V

Aliphatic Nucleophilic Substitution

The SN2, SN1 mixed SN1 and SN2 and SET mechanism. The neighboring group
mechanism, neighboring group participation by p and s bonds, anchimeric assistance.

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Classical and nonclassical carbocations, phenonium ions, norbornyl systems, common carbocation rearrangements. Application of NMR spectroscopy in the detection of carbocations. The S_N1 mechanism. Nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, phase transfer catalysis and ultrasound, ambident nucleophile, regioselectivity.

Book Suggested

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sundberg, Plenum.
3. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
4. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Cornell University Press.
5. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice-Hall.
6. Modern Organic Reactions, H.O. House, Benjamin.
7. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic & Professional.
8. Reaction Mechanism in Organic Chemistry, S.M. Mukherji and S.P. Singh, Macmillan.
9. Pericyclic Reactions, S.M. Mukherji, Macmillan, India.
10. Stereochemistry of Organic Compounds, D.Nasipuri, New Age International.

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M.Sc. Semester-I

Paper-III
MCH-403: PHYSICAL CHEMISTRY I

M.M. ~~35~~
M.M. 42 40

Unit-I

Introduction to Exact Quantum Mechanical Results

Schrodinger equation and the postulates of quantum mechanics. Discussion of solutions of the Schrodinger equation to some model systems viz., particle in a box, the harmonic oscillator, the rigid rotor, the hydrogen atom and helium atom.

Unit-II

Approximate Methods

The variation theorem, linear variation principle. Perturbation theory (First order and nondegenerate). Applications of variation method and perturbation theory to the Helium atom.

Molecular Orbital Theory

Huckel theory of conjugated systems bond and charge density calculations. Applications to ethylene, butadiene, cyclopropenyl radical cyclobutadiene etc. Introduction to extended Huckel theory.

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UNIT III

Angular Momentum

Ordinary angular momentum, generalized angular momentum, eigenfunctions for angular momentum, eigenvalues of angular momentum operator using ladder operators addition of angular momenta, spin, antisymmetry and Pauli exclusion principle.

Unit-IV

Classical Thermodynamics

Brief resume of concepts of laws of thermodynamics, free energy, chemical potential and entropies. Partial molar free energy, partial molar volume and partial molar heat content and their significance. Determinations of these quantities. Concept of fugacity and determination of fugacity. Non-ideal systems : Excess functions for non-ideal solutions. Activity, activity coefficient, Debye Huckel theory for activity coefficient for electrolytic solutions; determination of activity and activity coefficients; ionic strength. Application of phase rule to three component systems; second order phase transitions.

Unit-V

Statistical Thermodynamics

Concept of distribution, thermodynamic probability and most probable distribution. Ensemble averaging, postulates of ensemble averaging. Canonical, grand canonical and micro-canonical ensembles, corresponding distribution laws (using Lagrange's method of undetermined multipliers). Partition functions-translation, rotational, vibrational and electronic partition functions, Calculation of thermodynamic properties in terms of partition. Application of partition functions. Fermi-Dirac Statistics, distribution law and applications to metal. Bose-Einstein statistics distribution Law and application to helium.

Books Suggested

1. Physical Chemistry, P.W. Atkins, ELBS.
2. Introduction to Quantum Chemistry, A.K. Chandra, Tata Mc Graw Hill.
3. Quantum Chemistry, Ira N. Levine, Prentice Hall.
4. Coulson's Valence, R. Mc Weeny, ELBS.
5. Chemical Kinetics, K.J. Laidler, McGraw-Hill.
6. Kinetics and Mechanism of Chemical Transformation J. Rajaraman and J. Kurianose, Mc Millan.
7. Micelles, Theoretical and Applied Aspects, V. MOrsoli, Plenum.
8. Modern Electrochemistry Vol. I and Vol II J.O.M. Bockris and A.K.N. Reddy, Plenum.
9. Introduction to Polymer Science, V.R. Gowariker, N.V. Vishwanathan and J. Sridhar, Wiley Eastern.
10. Introduction to Quantum Chemistry-R.K. Prasad, New Age Publication.

Apurva
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Supriya
Rai
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Ashwini
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Rishi
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Shivam

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M.Sc. Semester-I

Paper-IV

MCH-404: Group Theory & Spectroscopy I

M.M. 40

M.M. 42 40

Unit-I

Symmetry and Group theory in Chemistry

Symmetry elements and symmetry operation, definition of group, subgroup. Conjugacy classes and classes. Point symmetry group. Schoenflies symbols, representations of groups by matrices (representation for the C_{2v} , C_{3v} , C_{4v} , D_{2h} group to be worked out explicitly). Character of a representation. The great orthogonality theorem (without proof) and its importance. Character tables and their use; spectroscopy. Derivation of character table for C_{2v} and C_{3v} point group Symmetry aspects of molecular vibrations of H_2O molecule.

Unit-II

Micro-wave Spectroscopy

Classification of molecules, rigid rotor model, effect of isotopic substitution on the transition frequencies, intensities, non-rigid rotor. Stark effect, nuclear and electron spin interaction and effect of external field. applications.

Unit-III

Infrared-Spectroscopy

Review of linear harmonic oscillator, vibrational energies of diatomic molecules, zero point energy, force constant and bond strengths; anharmonicity, Morse potential energy diagram, vibration-rotation spectroscopy. P.Q.R. branches, Breakdown of Oppenheimer approximation; vibrations of polyatomic molecules. Selection rules, normal modes of vibration, group frequencies, overtones, hot bands, factors affecting the band positions and intensities, far IR region, metal ligand vibrations, normal co-ordinate analysis.

Unit-IV

Raman Spectroscopy

Classical and quantum theories of Raman effect. Pure rotational, vibrational and rotational-rotational Raman spectra, selection rules, mutual exclusion principle, resonance Raman spectroscopy, coherent anti stokes Raman spectroscopy (CARS).

Unit-V

Electronic Spectroscopy

Molecular Spectroscopy

Energy levels, molecular orbitals, vibronic transitions, vibrational progressions and symmetry of the excited states, Franck-Condon principle, electronic spectra of polyatomic molecules. Emission spectra; radio-active and non-radioactive decay, internal conversion, spectra of transition metal complexes, charge-transfer spectra.

Photoelectron Spectroscopy

Basic principles; photo-electric effect, ionization process, Koopman's theorem

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Photoelectron spectra of simple molecules, ESCA, chemical information from ESCA.
Auger electron spectroscopy-basic idea.

Books suggested

1. Modern Spectroscopy, J.M. Hollas, John Wiley.
2. Applied Electron Spectroscopy for chemical analysis d. H. Windawi and F.L. Ho, Wiley Interscience.
3. NMR, NQR, EPr and Mossbauer Spectroscopy in Inorganic Chemistry, R. V. Parish, Ellis Harwood.
4. Physical Methods in Chemistry, R.S. Drago, Saunders College.
5. Chemical Applications of Group Theory, F.A. Cotton.
6. Introduction to Molecular Spectroscopy, G.M. Barrow, Mc Graw Hill.
7. Basic Principles of Spectroscopy, R. Chang, Mc Graw Hill.
8. Theory and Application of UV Spectroscopy, H.H. Jaffe and M. Orchin, IBH-Oxford.
9. Introduction to Photoelectron Spectroscopy, P.K. Ghosh, John Wiley.
10. Introduction to Magnetic Resonance. A Carrington and A.D. MacLachalan, Harper & Row.

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Unit-IV

Ordinary Differential equations

Zero order and first degree differential equations, homogenous, exact and linear equations. Applications to chemical kinetics, secular equilibria, quantum chemistry etc. Second order differential equation and their solutions.

Unit-V

Permutation and Probability

Permutations and combinations, probability and probability theorems average, variance and means square deviation examples from the kinetic theory of gases etc., fitting including least squares fit etc with a general polynomial fit.

Books Suggested

1. The chemistry Mathematics Book, E. Steiner, Oxford University Press.
2. Mathematics for chemistry, Doggett and Suicific, Logman.
3. Mathematical for Physical chemistry : F. Daniels, Mc. Graw Hill.
4. Chemical Mathematics D.M. Hirst, Longman.
5. Applied Mathematics for Physical Chemistry, J.R. Barante, Prentice Hall.
6. Basic Mathematics for Chemists, Tebbutt, Wiley.

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Unit-III

Lipid

Fatty acids, essential fatty acids, structure and function of triacylglycerols, glycerophospholipids, sphingolipids, cholesterol, bile acids, prostaglandins. Lipoproteins-composition and function, role in atherosclerosis. Properties of lipid aggregates-micelles, bilayers, liposomes and their possible biological functions. Biological membranes. Fluid mosaic model of membrane structure. Lipid metabolism-oxidation of fatty acids.

Unit-IV

Amino-acids, Peptides and Proteins

Chemical and enzymatic hydrolysis of proteins to peptides, amino acid sequencing. Secondary structure of proteins. force responsible for holding of secondary structures. α -helix, β -sheets, super secondary structure, triple helix structure of collagen. Tertiary structure of protein-folding and domain structure. Quaternary structure. Amino acid metabolism-degradation and biosynthesis of amino acids, sequence determination : chemical/enzymatic/mass spectral, racemization/detection. Chemistry of oxytocin and tryptophan releasing hormone (TRH).

Unit-V

Nucleic Acids

Purine and pyrimidine bases of nucleic acids, base pairing via Hbonding. Structure of ribonucleic acids (RNA) and deoxyribonucleic acid (DNA), double helix model of DNA and forces responsible for holding it. Chemical and enzymatic hydrolysis of nucleic acids. The chemical basis for heredity, an overview of replication of DNA, transcription, translation and genetic code. Chemical synthesis of mono and trinucleoside.

Book Suggested

1. Principles of Biochemistry, A.L. Lehninger, Worth Publishers.
2. Biochemistry, L. Stryer, W.H. Freeman.
3. Biochemistry, J. David Rawan, Neil Patterson.
4. Biochemistry, Voet and Voet, John Wiley.
5. Outlines of Biochemistry E.E. Conn and P.K. Stumpf, John Wiley.

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Supriya Baidoo
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(Duration: 6-8 hrs in each branch)

Practical examination shall be conducted separately for each branch

Inorganic Chemistry
Quantitative and quantitative Analysis
Chromatography
Preparation
Record
Viva Voce

PRACTICAL

8 hrs. m.m. (33)

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Practical Examination
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Jagdish Singh
R.K. Singh
Jyoti Singh
L. D. S. Yadav, I.R. Sarda

M.Sc. I Sem.

PRACTICAL

Duration: 6-8 hrs in each branch
Practical examination shall be conducted separately for each branch.

Inorganic Chemistry

- Preparations 12
- Chromatography 12
- Record 4
- Viva Voce 5
- Chromatography Separation of cations and anions by — Page No. I-53 to I-60,
Exp No. 5.0 to 5.9,
- Column Chromatography: Ion exchange.

Preparations
Preparation of selected inorganic compounds and their studies by IR, electronic spectra, Absorbance, ESR, and magnetic susceptibility measurements. Handling of air and moisture sensitive compounds.

1. $[\text{Co}(\text{NH}_3)_6][\text{Co}(\text{NO}_2)_6]$ — Exp No 3.13, Page No. I-30,
2. $\text{cis-}[\text{Co}(\text{en})_3](\text{NO}_2)_2 \cdot \text{Cl} \cdot \text{H}_2\text{O}$
3. $[\text{Hg}(\text{Co}(\text{SCN})_4)_2]$ — Exp No 3.16, Page No I-32
4. $[\text{Co}(\text{Py})_2\text{Cl}_2]$ — Exp. No 3.17 Page No 1-32
5. $[\text{Ni}(\text{NH}_3)_6]\text{Cl}_2$ — Exp No 3.7, Page No. I-26
6. $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4 \cdot \text{H}_2\text{O}$ — I-22, Inorganic Preparations, Chem. - 5 [3.1]

Organic Chemistry

- Organic Synthesis 12
- Quantitative Analysis 12
- Record 4
- Viva Voce 5

Organic Synthesis
Aldol condensation: Dibenzal acetone from benzaldehyde. Sandmeyer reaction: p-chlorobenzonitrile from p-toluidine. Acetoacetic ester Condensation: Synthesis of ethyl acetoacetate by A.E.E. condensation. Cannizzaro reaction: 4-Chlorobenzaldehyde and benzene. Friedel Crafts reaction: b-Benzoyl propionic acid from succinic anhydride and benzene. Aromatic electrophilic substitutions: Synthesis of p-nitroaniline and p-bromophenol. The Products may be Characterized by Spectral Techniques.

Quantitative Analysis

Determination of the percentage or number of hydroxyl groups in an organic compound by acetylation method/ Estimation of amines/phenols using bromate bromide solution or reduction method. Determination of iodine and Saponification values of an oil sample

Physical Chemistry

Page No - 0-182-185
Exp No 6.7, 6.8, 6.9

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Page 0-253
0-171 172

Page 0-17
Exp No 6-1
6-2
6-6
6-8

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conductometry
 potentiometry/pHmetry
 conductometry
 acid
 base

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conductometry

- Determination of the velocity constant, order of the reaction and energy of activation for saponification of ethyl acetate by sodium hydroxide conductometrically.
- Determination of solubility and solubility product of sparingly soluble salts (e.g. $PbSO_4$, $BaSO_4$) conductometrically. 265
- Determination of the strength of strong and weak acid in a given mixture conductometrically.
- to study of the effect of solvent on the conductance of $AgNO_3$ acetic acid and to determine the degree of dissociation and equilibrium constant in different solvent and in their mixtures (DMSO, DMF, dioxane, acetone, water) and to test the validity of Debye-Huckel-Onsager theory.
- Determination of the activity coefficient of zinc ions in the solution of 0.002 M zinc sulphate using Debye Huckel's limiting law.

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potentiometry/pHmetry

- 1. Determination of strengths of halides in a mixture potentiometrically. 316 P. 146
- 2. Determination of the valency of mercurous ions potentiometrically. 320 P. 147 - P. 132, 7.11
- 1. Determination of the strength of strong and weak acids in a given mixture using a potentiometer/pH meter.
- 4. Determination of temperature dependence of EMF of a cell.
- 5. Determination of the formation constant of silver-ammonia complex and stoichiometry of the complex potentiometrically.
- 6. Acid-base titration in a non-aqueous media using a pH meter.
- 7. Determination of activity and activity coefficient of electrolytes P-146, Exp. No. 7.16
- 8. Determination of the dissociation constant of acetic acid in DMSO, DMF, acetone and dioxane by titrating it with KOH. Page No. P-147, Exp. No. 7.17
- 9. Determination of the dissociation constant of monobasic/dibasic acid by Albert-Schrijant method. Exp. No. 7.17 Page No. 147 - P. 7.17
- 10. Determination of thermodynamic constants, ΔG , ΔS , and ΔH for the reaction by e.m.f. method. $Zn + H_2SO_4 \rightarrow ZnSO_4 + 2H$

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Polarimetry

- 1. Determination of rate constant for hydrolysis/inversion of sugar using a polarimeter. 215 P. 147, Exp. No. 51, Page No. I-92
- 2. Enzyme kinetics-inversion of sucrose.

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Books Suggested

11. Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R.A. Denney, G.H. Jefferys and I. Mendham, ELBS.
12. Synthesis and Characterization of Inorganic Compounds, W.L. Jolly, Prentice Hall.
13. Experiments and Techniques in Organic Chemistry, D.P. Pasto, C. Johnson and M. Miller, Prentice Hall.
14. Macroscale and Microscale Organic Experiments, K.L. Williamson, D.C. Heath.
15. Systematic Qualitative Organic Analysis, H. Middleton, Edward Arnold.
16. Handbook of Organic Analysis-qualitative and Quantitative, H. Clark, Edward Arnold.
17. Vogel's Textbook of Practical Organic Chemistry, A.R. Tatchell, John Wiley.
18. Practical Physical Chemistry, A.M. James and F.E. Prichard, Longman.
19. Findley's Practical Physical chemistry, B.P. Levitt, Longman.
20. Experimental Physical Chemistry, R.C. Das and B. Behera, Tata McGraw Hill.

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PAPER II

Paper I

MCH-406 : INORGANIC CHEMISTRY II

Unit - I

Electronic Spectral Studies of Transition Metal Complex :

Electronic ground states, correlation. Orgel and Tanabe-Sugano diagrams for transition metal complexes (d^1, d^6, d^7, d^8, d^9 states), Selection rule for electronic spectroscopy, Intensity of various electronic transitions. Calculations of $10Dq, B$ and β parameters, charge transfer spectra.

Unit - II

Magnetic Properties of Transition Metal Complexes :

Spin only magnetic moments, Quenching of orbital contribution, Orbital contribution to magnetic moment, magnetic exchange coupling and spin crossover, TIP (Temp Independent Paramagnetism)

Unit - III

Metal Carbonyl Complexes :

Metal carbonyl, structure and bonding, vibrational spectra of metal carbonyls for bonding and back bonding, important reaction of metal carbonyls; preparation, bonding structure and reaction of transition metal nitrosyl, dinitrogen and dioxygen complexes; tertiary amine as ligand; Metal olefin bonding.

Unit - IV

Cluster :

Carboranes, carboranes, metalloboranes and metallo-carboranes compound with metal metal bonds.

Unit - V

Optical Rotatory Dispersion and Circular Dichroism :

Plane and circularly polarized light; optical rotatory power and circular birefringence, ellipticity and circular dichroism; ORD and cotton effect, Faraday and Kerr effects; Assignment of circular dichroism; ORD and cotton effect, Faraday and Kerr effects; Assignment of electronic transitions; applications of ORD and CD for the determination of (i) absolute configuration of complexes and (ii) isomerism due to non-planarity of chelate rings.

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SEMESTER II

Paper-I
MCH-406: INORGANIC CHEMISTRY II

M.M. 40

Unit-I

Electronic Spectral Studies of Transition Metal Complexes :
Spectroscopic ground states, correlation. Orgel and Tanabe-Sugano diagrams for transition metal complexes (d^1-d^9 states), Selection rule for electronic spectroscopy. Intensity of various type electronic transitions. Calculations of $10Dq$, B and β parameters, charge transfer spectra.

Unit-II

Magnetic Properties of Transition Metal Complexes

Anomalous magnetic moments, Quenching of Orbital contribution. Orbital contribution to magnetic moment, magnetic exchange coupling and spin crossover;

TIP (Temp. Ind. Paramagn. Trans.)

Unit-III

Metal π -Complexes

Metal carbonyl, structure and bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation, important reactions of metal carbonyls; preparation, bonding structure and important reaction of transition metal nitrosyl, dinitrogen and dioxygen complexes; tertiary phosphine as ligand;

Unit-IV

Metal Clusters

Higher boranes, carboranes, metalloboranes and metallo-carboranes compounds with metal metal multiple bonds.

Unit-V

Optical Rotatory Dispersion and Circular Dichroism

Linearly and circularly polarized lights; optical rotatory power and circular birefringence, ellipticity and circular dichroism; ORD and Cotton effect, Faraday and Kerr effects; Assignment of electronic transitions; applications of ORD and CD for the determination of (i) absolute configuration of complexes and (ii) isomerism due to non-planarity of chelate rings.

Books Suggested :

- Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley.
- Inorganic Chemistry, J.E. Huhey, Harpes & Row.
- Chemistry of the Elements. N.N. Greenwood and A. Earnshaw, Pergamon.
- Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier.
- Magnetochemistry, R.I. Carlin, Springer Verlag.
- Comprehensive Coordination Chemistry eds., G. Wilkinson, R.D. Gillars and J.A. Mc Cleverty, Pergamon.

d^8, d^9

metal-oxygen bonding

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II
Paper-~~VII~~
MCH-407: ORGANIC CHEMISTRY II

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Unit-I

Aromatic Electrophilic Substitution

The arenium ion mechanism, orientation and reactivity, energy profile diagrams. The ortho/para ratio, ipso attack, orientation in other ring systems. Quantitative treatment of reactivity in substrates and electrophiles. Diazonium coupling, Vilsmeier reaction, Gatterman-Koch reaction

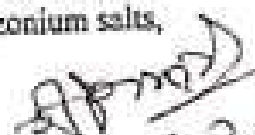
Aromatic Nucleophilic Substitution

The S_NAr S_N1, benzyne and S_Ni mechanism, Reactivity effect of substrate structure, leaving group and attacking nucleophile. The Von Richter, Sommelet-Hauser, and Smiles rearrangements.

Unit-II

Free Radical Reactions

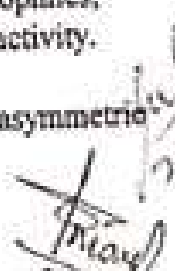
types of free radical reactions, free radical substitution mechanism, mechanism at an aromatic substrate, neighbouring group assistance. Reactivity for aliphatic and aromatic substrates at a bridgehead. Reactivity in the attacking radicals. The effect of solvents on reactivity. Allylic halogenation (NBS), oxidation of aldehydes to carboxylic acids, auto-oxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts, Sandmeyer reaction. Free radical rearrangement. Hunsdiecker reaction.


02/20

Unit III

Addition Reactions

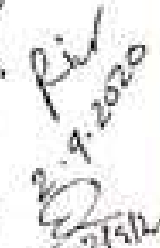
Mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio-and chemoselectivity, orientation and reactivity. Addition to cyclopropane ring. Hydrogenation of double and triple bonds, hydrogenation of aromatic rings. Hydroboration, Michael reaction, sharpless asymmetric epoxidation.


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Unit-IV

Addition to Carbon-Hetero Multiple bonds

Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acid esters and nitriles. Addition of Grignard reagents, organozinc and organolithium reagents to carbonyl and unsaturated carbonyl compounds. Wittig reaction. Mechanism of condensation reactions involving enolates-Aldol, Knoevenagel, Claisen, Mannich, Benzoin, Perkin and Stobbe reactions. Hydrolysis of esters and amides, ammonolysis of esters.


21/9/2020

Elimination Reactions

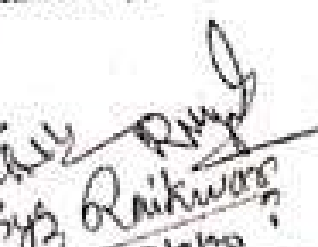
The E₂, E₁ and E_{1cB} mechanisms and their spectrum. Orientation of the double bond. Reactivity-effects of substrate structures, attacking base, the leaving group and the medium. Mechanism and orientation in pyrolytic elimination.


PTO

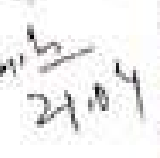
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Unit-V

Pericyclic Reactions

Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatriene and allyl system. Classification of pericyclic reactions. Woodward-Hoffmann correlation diagrams. FMO and PMO approach. Electrocyclic reactions-conrotatory and disrotatory motions, $4n$ and $4n+2$ and allyl systems. Cycloadditions-antarafacial and suprafacial additions, $4n$ and $4n+2$ systems, 2+2 addition of ketenes, 1,3 dipolar cycloadditions and cheletropic reactions. Sigmatropic rearrangements-suprafacial and antarafacial shifts of H, sigmatropic involving carbon moieties, 3,3- and 5,5 sigmatropic rearrangements. Claisen, Cope and aza-Cope rearrangements. Fluxional tautomerism. Ene reaction.

Book Suggested

12. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
13. Advanced Organic Chemistry, F.A. Carey and R.J. Sundberg, Plenum.
14. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
15. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Cornell University Press.
16. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice-Hall.
17. Modern Organic Reactions, H.O. House, Benjamin.
18. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic & Professionals.
19. Reaction Mechanism in Organic Chemistry, S.M. Mukherji and S.P. Singh, Macmillan.
20. Pericyclic Reactions, S.M. Mukherji, Macmillan, India
21. Stereochemistry of Organic Compounds, D.Nasipuri, New Age International.
22. Stereochemistry of Organic Compounds, P.S. Kalsi, New Age International.

Paper-VIII

MCH-408: PHYSICAL CHEMISTRY II

M.M. (25)

Unit-I

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 reactions, kinetic salt effects, steady state kinetics, kinetic and thermodynamic control of reactions, treatment of unimolecular reactions. Dynamic chain (hydrogen-bromine reaction, pyrolysis of acetaldehyde, decomposition of ethane), photochemical (hydrogen-bromine and hydrogen-chlorine reactions) and homogenous catalysis, kinetics of enzyme reactions, general features for fast reactions, study of fast reactions by flow method, relaxation method, flash photolysis and the nuclear magnetic resonance method, dynamics

all
21/10/14

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21/10/14

21/10/14

21/10/14

Paper III

Paper-III
MCH-408: PHYSICAL CHEMISTRY II

m.m. ~~25~~
~~40~~ 40

Chemical Dynamics

Unit-I

Methods of determining rate laws, collision theory of reaction rates, steric factor, activated complex theory, Arrhenius equation and the activated complex theory; ionic reactions, kinetic salt effects, steady state kinetics, kinetic and thermodynamic control of reaction, pyrolysis of acetaldehyde, decomposition of ethane, photochemical (hydrogen-bromine and hydrogen-chlorine reactions) and homogenous catalysis, kinetics of enzyme relaxation method, flash photolysis and the nuclear magnetic resonance method, dynamics

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of unimolecular reactions (Lindemann Hinshelwood and Rice-Ramsperger-Kassel-Marcus (RRKM) theories for unimolecular reactions).

Unit-II

Surface Chemistry

Adsorption

Surface tension, capillary action, pressure difference across curved surface (Laplace equation), vapour pressure of droplets (Kelvin equation), Gibbs adsorption isotherm, estimation of surface area (BET equation), Surface films on liquids (Electro-kinetic phenomenon).

Micelles

Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization-phase separation and mass action models, solubilization, micro emulsion, reverse micelles.

Unit-III

Macromolecules

Polymer-definition, types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of polymerization, mechanism of polymerization. Molecular mass, number and mass average molecular mass, molecular mass determination (Osmometry, viscometry, diffusion and light scattering methods), sedimentation, chain configuration of macromolecules, calculation of average dimension of various chain structures.

Unit-IV

Non Equilibrium Thermodynamics

Thermodynamic criteria for non-equilibrium states, entropy production and entropy flow, entropy balance equations for different irreversible processes (e.g., heat flow, chemical reaction etc.) transformations of the generalized fluxes and forces, non equilibrium stationary states, phenomenological equations, microscopic reversibility and Onsager's reciprocity relations, electrokinetic phenomena, diffusion, electric conduction.

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Unit-V

Electrochemistry

Electrochemistry of solutions. Debye-Huckel-Onsager treatment and its extension, ion solvent interactions, Debye-Huckel-Jerum mode. Thermodynamics of electrified interface equations. Derivation of electro capillarity, Lippmann equations (surface excess), methods of determination. Structure of electrified interfaces.

Overpotentials, exchange current density, derivation of Butler Volmer equation, Tafel plot. Quantum aspects of charge transfer at electrodes-solution interfaces, quantization of charge transfer, tunneling. Semiconductor interfaces-theory of double layer at

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semiconductor, electrolyte solution interfaces, structure of double layer interfaces. Effect of light at semiconductor solution interface. Polarography theory, Ilkovic equation; half wave potential and its significance.

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conductivity
 conductivity
 conductivity
 conductivity

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conductometry

- Determination of the velocity constant, order of the reaction and energy of activation for saponification of ethyl acetate by sodium hydroxide conductometrically.
- Determination of solubility and solubility product of sparingly soluble salts (e.g. $PbSO_4$, $BaSO_4$) conductometrically.
- Determination of the strength of strong and weak acid in a given mixture conductometrically.
- to study of the effect of solvent on the conductance of $AgNO_3$ /acetic acid and to determine the degree of dissociation and equilibrium constant in different solvents and in their mixtures (DMSO, DMF, dioxane, acetone, water) and to test the validity of Debye-Huckel-Onsager theory.
- Determination of the activity coefficient of zinc ions in the solution of 0.002 M zinc sulphate using Debye Huckel's limiting law.

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potentiometry/pH metry

- Determination of strengths of halides in a mixture potentiometrically. 515 P 001
- Determination of the valency of mercurous ions potentiometrically. 520 P 015
- Determination of the strength of strong and weak acids in a given mixture using a potentiometer/pH meter.
- Determination of temperature dependence of EMF of a cell.
- Determination of the formation constant of silver-ammonia complex and stoichiometry of the complex potentiometrically.
- Acid-base titration in a non-aqueous media using a pH meter.
- Determination of activity and activity coefficient of electrolytes.
- Determination of the dissociation constant of acetic acid in DMSO, DMF, acetone and dioxane by titrating it with KOH.
- Determination of the dissociation constant of monobasic/dibasic acid by Albert-Idrjeant method.
- Determination of thermodynamic constants, ΔG , ΔS , and ΔH for the reaction by m.f. method. $Zn + H_2SO_4 \rightarrow ZnSO_4 + 2 H$

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kinetics

- Determination of rate constant for hydrolysis/inversion of sugar using a polarimeter. 215 P 001
- kinetic kinetics-inversion of sucrose.

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Paper I

Department of Higher Education, Govt. of M.P.
 Post Graduate Semester wise Syllabus
 as recommended by Central Board of Studies and approved by the Government of M.P.
 उत्तर शिक्षा विभाग, म.प्र. शासन
 मासिकवार अर्थात् दो दिने परीक्षा अग्रिम सूचना
 कक्षा के अनुसार परीक्षा का आयोजन तथा म.प्र. के अधिकांश विश्वविद्यालयों में

Session (वर्ष) 2019-20 20.12.20

Class / कक्षा : M. Sc.
 Semester / सेमेस्टर : III semester
 Subject / विषय : Botany
 Title of Subject Group : Plant Physiology
 विषय समूह का शीर्षक :
 Paper No. / परीक्षा क्रमांक : PG 301
 Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य : Compulsory
 Max. Marks अधिकतम अंक : 4240
 : 40+10

Particulars / विषय

Unit-1	Structure and functions of ATP. Plant water relations, mechanisms of water transport through xylem, root-microbe interactions in facilitating nutrient uptake. Membrane transport proteins.
Unit-2	Phloem transport, phloem loading and unloading, passive and active solute transport. Signal transduction; overview, receptors and proteins, phospholipids signaling, role of cyclic nucleotides, calcium-calmodulin cascade. Specific signaling mechanisms, for example, two-component sensor regulator system in bacteria and plants.
Unit-3	Plant growth regulators and elicitors. Physiological effects and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, jasmonic acid, and salicylic acid. Hormone receptors.
Unit-4	Flowering process, photoperiodism and its significance, endogenous clock and its regulation. Floral induction and development. Phytochromes and cryptochromes, their photochemical and biochemical properties, Role of vernalization.
Unit-5	Stress physiology. Plant responses to biotic and abiotic stress. Water deficit and drought resistance. Salinity stress and resistance. Concepts of freezing, heat and oxidative stresses.

1/08/2020

Dr. Abhishek Verma

Suggested Laboratory Exercise based on P.G 301 :

1. Radioisotope methodology, autoradiography, instrumentation (GM counter & scintillation counter) and principles involved.
2. Principles of colorimetry, Spectrophotometry and fluorimetry.
3. Determine rate of transpiration by Ganong's potometer.
4. Determine rate of respiration in germinating/young buds by Ganong's respirometer.

Dr. Archana Verma

- 5/19/19
1. Dr. C. O. Athia
 2. Dr. A. K. Patil
 3. Dr. Ela Tiwari
 4. Dr. Anila Arora
 5. Dr. Pratima Khare
- Dr. Archana Verma
@Gwal

Department of Higher Education, Govt. of M.P.
 Post Graduate Semester wise Syllabus
 as recommended by Central Board of Studies and approved by the Governor of M.P.
 उच्च शिक्षा विभाग, म.प्र. शासन
 मध्य प्रदेश सरकार के शिक्षा विभाग द्वारा अनुमोदित
 केन्द्रीय अध्ययन समिति द्वारा अनुमोदित तथा म.प्र. के राज्यपाल द्वारा अनुमोदित

Session (सत्र) 2010-2011 2019-20

Class / कक्षा : M.Sc.
 Semester / सेमेस्टर : III semester
 Subject / विषय : Botany
 Title of Subject Group : Plant Biochemistry & Metabolism
 विषय समूह का शीर्षक :
 Paper No. / प्रश्नपत्र क्रमांक : PG 302
 Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य : Compulsory
 Max. Marks अधिकतम अंक ~~45+45+50~~ 40 + 10

Particulars / विवरण

Unit-1	Fundamentals of enzymology: allosteric mechanism, regulatory and active sites, Isozymes, kinetics of enzymatic catalysis, Michaelis-Menten equation and its significance, Mechanism of enzyme action.
Unit-2	Photochemistry and photosynthesis: General concepts, evolution of photosynthetic apparatus, photosynthetic pigments and light-harvesting complexes. Photolysis of water, mechanism of electron and proton transport, Carbon assimilation, Calvin cycle, photorespiration and its significance, C ₃ -cycle, CAM pathway, physiological and ecological considerations.
Unit-3	Respiration and lipid metabolism: Overview of plant respiration, glycolysis, TCA cycle, electron transport and ATP synthesis, Oxidative pentose phosphate pathway, glyoxylate cycle, alternative oxidase system.
Unit-4	Structure and functions of lipids, fatty acid biosynthesis, structural lipids and storage lipids and their catabolism. Sulphate uptake, transport and assimilation.
Unit-5	Nitrogen fixation, nitrogen and sulphur metabolism: Overview, biological nitrogen fixation, nodule formation, Mechanism of uptake and reduction, ammonium assimilation.

PG/302 Unit-5

Suggested Laboratory Exercise based on P.G 302 :

1. Effect of time and enzyme concentration on the rate of reaction of enzyme C e.g. acid Phosphatase, nitrate reductase.
2. Effect of substrate concentration on activity of any enzyme C (catalase, Amylase)
3. Demonstration of the substrate inducibility of the enzyme nitrate reductase
4. Determination of succinate dehydrogenase activity, Its kinetics and sensitivity to inhibitors.

Dr. C.D. Athig
 Dr. A.K. Pateng
 Dr. Ela Tiwari
 Dr. Amita Arjuna
 Dr. Pradip Khare
 Dr. Pratana Verma
 Dr. Ashok

Session (03) 2019-2020

Class / कक्षा : M.Sc.
 Semester / सेमेस्टर : III semester
 Subject / विषय : Botany
 Title of Subject Group : Genetics & Cytogenetics
 विषय समूह का शीर्षक :
 Paper No. / प्रश्नपत्र क्रमांक : PG 103
 Compulsory / अनिवार्य या Optional / वैकल्पिक अधिवार्य : Compulsory
 Max. Marks अधिकतम अंक 42 40 45+40=13750 100+10

Particulars / विवरण

Unit-1	Genetics of prokaryotes and eukaryotic, genetic recombination in prokaryotes, genetic transformation, conjugation and transduction in bacteria. Genetics of mitochondria and chloroplasts, cytoplasmic male sterility
Unit-2	Genetic recombination and genetic mapping in eukaryotes. Recombination, independent assortment and crossing-over, molecular mechanism of recombination. Chromosome mapping, linkage groups, genetic markers, construction of molecular maps, somatic cell genetics- an alternative approach to gene mapping
Unit-3	Mutations spontaneous and induced mutations, physical and chemical mutagens, molecular basis of gene mutations. Transposable elements in prokaryotes and eukaryotes. Mutations induced by transposons, DNA damage and repair mechanisms
Unit-4	Cytogenetics of numerical and structural changes of chromosomes. Euploidy, aneuploidy origin, meiosis and effect. Cytogenetics of deficiencies, duplication, inversions and translocation
Unit-5	Molecular Cytogenetics, Nuclear DNA content, c-value paradox, col curve and its significance, restriction mapping – concept and techniques, multigene families and their evolution. Transfer of whole genome, examples from wheat and <i>Brassica, Arabidopsis</i>

29/08/2020

Suggested Laboratory Exercise based on P.G. 103 :

1. Isolation of DNA & preparation of T₁ curve
2. Demonstration of SEM & TEM
3. Isolation of Mitochondria and its marker enzyme, succinate dehydrogenase (SDH)
4. Demonstration of Mitosis/ Meiosis (chemical & allopurinol)

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7. *[Signature]*

Dr. C. D. Atwiga
 Dr. A. K. Patil
 Dr. E. la. Tiwari
 Dr. Anita Aryanig
 Dr. Pratiksha K. K. K.

Department of Higher Education, Govt. of M.P.
 Post Graduate Semester wise Syllabus
 as recommended by Central Board of Studies and approved by the Government of M.P.
 एवं उच्च शिक्षण विभाग द्वारा मंजूर
 एम. एड. स्तर पर प्रस्तावित एवं मंजूर किया गया है।
 एम. एड. स्तर पर प्रस्तावित एवं मंजूर किया गया है।

Session (III) 2019-2020

Class / कक्षा : M.Sc.
 Semester / सेमेस्टर : III semester
 Subject / विषय : Botany
 Title of Subject Group : Molecular Biology
 विषय समूह का शीर्षक :
 Paper No. / प्रश्नपत्र संख्या : PG 304
 Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य : Compulsory
 Max. Marks अधिकतम अंक : 35+10+15=60 **40+10**

Particulars / विवरण

Unit-1	DNA structure; A, B and Z forms; transcription; plant promoters and transcription factors; splicing; messenger RNA transport; ribosomal RNA biosynthesis
Unit-2	Gene structure and expression; genetic fine structure; cis-trans test; fine structure analysis of eukaryotes, introns and their significance; RNA splicing; regulation of gene expression in prokaryotes and eukaryotes.
Unit-3	Ribosomes: structure and site of protein synthesis, mechanism of translation, initiation, elongation and termination, structure and role of transfer RNA; protein sorting, targeting of proteins to organelles
Unit-4	Cell cycle and apoptosis, control mechanisms; role of cyclins and cyclin dependent kinases, cytokinesis and cell plate formation; mechanism of programmed cell death; DNA replication in prokaryotes and eukaryotes
Unit-5	Immunotechniques, in situ hybridization - concepts and techniques, physical mapping of genes on chromosomes. In situ hybridization to locate transcript in cell types; FISH, Flow cytometry.

Suggested Laboratory based on PG 304:

1. Isolation of genomic DNA from plant tissue using CTAB (cetyltrimethyl ammonium bromide) or any animal tissue.
2. Isolation of DNA & its quantitation by a spectrophotometric method.
3. Restriction digestion of plant DNA, its separation by Agrose gel electrophoresis and visualization by ethidium bromide staining.
4. Isolation of RNA and quantitation by a spectrophotometric method.
5. Separation of RNA by Agrose gel electrophoresis and visualization by Et. Br. staining.
6. Immunological techniques, Double antibody method, ELISA & western blotting.
7. Isolation of chloroplasts and SDS-PAGE, profile of proteins to demarcate the two subunits of Rubisco.

Other experiments based on theory paper.

- 1 - Dr. C.D. Atriya
- 2 - Dr. Archana Verma
- 3 - Dr. A.K. Pateng
- 4 - Dr. Elq Tiwari
- 5 - Dr. Anita Arjani
- 6 - Dr. Pratima Khare

Dr. Archana Verma

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Department of Higher Education, Govt. of M.P.
 Post Graduate Semester wise Syllabus
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 उच्च शिक्षा विभाग, म.प्र. शासन
 स्नातकोत्तर कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम
 केंद्रीय अध्ययन मण्डल द्वारा अनुमोदित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित
 Session (सत्र) 2010-2011

Approved
 02/9/20

28/11/20
 Recd
 2-9-2020

2/19/2020

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Class / कक्षा
 Semester / सेमेस्टर
 Subject / विषय
 Title of Subject Group
 Paper No. / प्रश्नपत्र क्रमांक
 Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य
 No. Marks अधिकतम अंक

: M.Sc.
 : IV
 : Chemistry
 : **SOLID STATE CHEMISTRY**
 :
 : II (Code- MCH-512)
 : Compulsory
 : 60 ~~25~~ ~~40~~ **(40)**

Particulars / विवरण

Unit-1	Solid State Reactions General principles, experimental procedure, co-precipitation as a precursory to solid state reactions, kinetics of solid state reactions.
Unit-2	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. Thermodynamics of Schottky and Frenkel defect formation, colour centres, non-stoichiometry and defects.
Unit-3	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, super conductors. Optical properties-Application of optical and electron microscopy. Magnetic Properties-Classification of materials ; Effect of temperature calculation of magnetic moment, mechanism of ferro and anti ferromagnetic ordering super exchange.
Unit-4	Organic Solids Electrically conducting solids. organic charge transfer complex, organic metals, new superconductors.
Unit-5	Liquid Crystals: Types of liquid crystals: Nematic, Smectic, Ferroelectric, Antiferroelectric, Various theories of LC. Liquid crystal display, New materials.

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 suggested. *Rajendra*
 9-8-11 *Rajendra*
 Feb 2011

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Solid state chemistry and its applications, A.R. West. Peenum.
 Principles of the Solid State, H.V. Keer, Wiley Eastern.
 Solid State Chemistry, N.B. Hannay.
 Solid State Chemistry, D.K. Chakrabarty, New Wiley Eastern.

17-7-15
AR

Department of Higher Education, Govt. of M.P.
 Post Graduate Semester wise Syllabus
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 उच्च शिक्षा विभाग, म.प्र. शासन
 बनासकोटार कक्षाओं के लिए पोस्टर अनुसार पाठ्यक्रम
 केंद्रीय अध्ययन परिसर द्वारा अनुमोदित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित
 Session (सत्र) 2010-2011

Approved
 02/9/20

Rev
 2.9.2020

Rev
 2/9/20

Rev
 02/9/20

Class / कक्षा : M.Sc.
 Semester / सेमेस्टर : IV
 Subject / विषय : Chemistry
 Title of Subject Group : **BIOCHEMISTRY**
 Group / समूह का शीर्षक :
 Paper No. / प्रश्नपत्र क्रमांक :
 Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य : III (Code- MCH-513)
 Min. Marks अधिकतम अंक : 40
 : Compulsory
 : 50

Particulars / विवरण

Unit-1	<p>Metal Ions in Biological Systems Bulk and trace metals with special reference to Na, K, Mg, Ca, Fe, Cu, Zn, Co, and K⁺/Na⁺ pump. Bioenergetics and ATP Cycle. DNA polymerisation, glucose storage, metal complexes in transmission of energy; chlorophyll's, photosystem I and photosystem II in cleavage of water. Transport and Storage of Dioxygen Haem proteins and oxygen uptake structure and function of haemoglobin's, myoglobin, haemocyanins and hemerythrin, model synthetic complexes of iron, cobalt and copper</p>
Unit-2	<p>Electron Transfer in Biology Structure and function of metal of proteins in electron transport processes cytochrome's and iron-sulphure proteins, synthetic models. Nitrogen fixation Biological nitrogen fixation, and its mechanism, nitrogenase, Chemical nitrogen fixation.</p>
Unit-3	<p>Enzymes Introduction and historical perspective, chemical and biological catalysis, remarkable properties of enzymes like catalytic power, specificity and regulation. Nomenclature and classification, extraction and purification. Fischer's lock and key and Koshland's induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis. Enzyme kinetics, Michael's-Menten and Lineweaver Burk plots, reversible and irreversible inhibition. Mechanism of Enzyme Action Transition-state theory, orientation and Steric effect, acid-base catalysis, covalent catalysis, strain or distortion. Examples of some typical enzyme mechanisms for chymotrypsin, ribonuclease, lysozyme and carboxypeptidase. Kinds of Reactions Catalysed by Enzymes Nucleophilic displacement on a phosphorus atom, multiple displacement reactions and the coupling of ATP cleavage to endergonic processes. Transfer of sulphate, addition and elimination reactions, enolic intermediates in Isomerisations reactions, b-Cleavage and condensation, some isomerization and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation.</p>

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Rev
 02/9/20

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Department of Higher Education, Govt. of M.P.
 Post Graduate Semester wise Syllabus
 as recommended by Central Board of Studies and approved by the Governor of M.P.

उच्च शिक्षा विभाग, म.प्र. सरकार
 एकात्मिक कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम
 केंद्रीय अध्ययन मन्दाळ द्वारा अनुमोदित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित
 Session (सत्र) 2010-2011

Approved
 02/9/20

Recd
 29/2/2020

Recd
 2/19/2020

Recd
 29/9/20

Recd
 02/7/20

Unit-4	<p>Co-Enzyme Chemistry Cofactors as derived from vitamins, coenzymes, prosthetic groups, apoenzymes. Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD⁺, NADP⁺, FMN, FAD, lipoic acid, vitamin B12. Mechanisms of reactions catalyzed by the above cofactors. Enzyme Models Host-guest chemistry, chiral recognition and catalysis, molecular recognition, molecular asymmetry and prochirality Biometric chemistry, crown ether, cryptates. Cyclodextrins, cyclodextrin-based enzyme models, clisarenes, ionospheres, micelles synthetic enzymes or synzymes. Biotechnological Applications of Enzymes large-scale production and purification of enzymes, techniques and methods of immobilization of enzymes, effect of immobilization on enzyme activity, application of immobilized enzymes, use of enzymes in food and drink industry-brewing and cheese-making, syrups from corn starch, enzymes as targets for drug design. Clinical uses of enzymes, enzyme therapy, enzymes and recombinant DNA Technology.</p>
Unit-5	<p>Biological Cell and its Constituents Biological cell, structure and functions of proteins, enzymes, DNA and RNA in living systems. Helix coils transition. Bioenergetics Standard free energy change in biochemical reactions, exergonic, endergonic. Hydrolysis of ATP, synthesis of ATP from ADP. Biopolymer Interactions Forces involved in biopolymer interactions. Electrostatic charges and molecular expansion, hydrophobic forces, dispersion force interactions. Multiple equilibrium and various types of binding processes in biological systems. Hydrogen ion titration curves. Cell Membrane and Transport of Ions Structure and functions of cell membrane, ion transport through cell membrane, irreversible thermodynamic treatment of membrane transport. Nerve conduction.</p>

Books Suggested

1. Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books.
2. Bioinorganic Chemistry, I. Bertini, H.B. Gray, S.J. Lippard and J.S. Valentine, University Science Books.
3. Inorganic biochemistry vol. I and II ed. G.L. Eichhorn, Elsever.
4. Progress in Inorganic Chemistry, Vol 18 and 38 ed J.J. Lippard, Wiley.
5. Bioinorganic Chemistry : A chemical Approach to Enzyme Action, Hermann Dugas and C. Penny, Springer Verlag.
6. Understanding Enzymes, Trevor Palmer, Prentice Hall.
7. Enzyme Chemistry : Impact and applications, Ed. Collin J suckling, chemistry.
8. Enzyme Mechanisms Ed. M.J. Page and A. Williams, Royal Society of Chemistry.
9. Fundamentals of Enzymology, N.C. Price and L. Stevens, Oxford University Press.
10. Immobilized Enzymes : An Introduction and Applications in Biotechnology, Michael ID. Trevan, John Wiley.
11. Inzymatic Reaction Mechanisms. C. Walsh. W.H. Freeman.

AR
 29/9/20

Approved
 02/7/20

Feb 2011
 Rainwar
 M.D.

Department of Higher Education, Govt. Of M.P.

Post Graduate Semester Wise Syllabus

as recommended by Central Board of Studies and approved by the Governor of M.P.

(As per recommended by Board of Studies held on 02/09/2020)

For Session -2020-21

Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: IV
Subject / विषय	: Chemistry
Title of Subject Group	: Medicinal Chemistry
विषय समूह का शीर्षक	
Paper No. / प्रश्नपत्र क्रमांक	: V, OPT-5 (Code- MCH-518)
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Optional
Max. Marks / अधिकतम अंक	: 40

Particulars / विवरण

Unit-1	Structure and activity : Relationship between chemical structure and biological activity (SAR). Receptor Site Theory. Approaches to drug design. Introduction to combinatorial synthesis in drug discovery. Factors affecting bioactivity. QSAR-Free- Wilson analysis, Hansch analysis, relationship between Free- Wilson analysis and Hansch analysis.
Unit-2	Pharmacodynamics : Introduction, elementary treatment of enzymes stimulation, enzyme inhibition, sulphonamides, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry.
Unit-3	Antibiotics and antibacterials Introduction, Synthesis applications and adverse effects of Antibiotic- β -Lactam type - Penicillins, Cephalosporins, Antitubercular - Streptomycin, Broad spectrum antibiotics - Tetracyclines, Anticancer - Dactinomycin (Actinomycin D)
Unit-4	Antifungal - Introduction, Synthesis and applications of polyenes, Antibacterial- Ciprofloxacin, Norfloxacin, Antiviral - Acyclovir Antimalarials : Chemotherapy of malaria. SAR. Chloroquine, Chloroguanide and Mefloquine
Unit-5	Non-steroidal Anti-inflammatory Drugs : Introduction, Synthesis and applications of Diclofenac Sodium, Ibuprofen and Netopam Antihistaminic and antiasthmatic agents : Introduction, Synthesis and applications of Terfenadine, Cinnarizine, Salbutamol and Beclomethasone dipropionate.

Approved
02/9/2020

AA
02.09.2020

Bhatnagar

Approved
02/9/2020
Ravi

Department of Higher Education, Govt. of M.P.
 Post Graduate Semester wise Syllabus
 as recommended by Central Board of Studies and approved by the Governor of M.P.
 राज्य शिक्षा विभाग, मध्य प्रदेश
 स्नातकोत्तर कक्षाओं के लिए सेमेस्टर अनुसार पाठ्यक्रम
 केंद्रीय अध्ययन मण्डल द्वारा अनुमोदित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित
 Session (सत्र) 2010-2011

Approved
 22/9
 2020
 2-9-2020
 21/10/20

सत्र / सेमेस्टर
 वर्ष / विषय
 Subject Group
 स्तर या शीर्षक
 प्रमाणपत्र क्रमांक
 अनिवार्य या Optional / वैकल्पिक अनिवार्य
 अधिकतम अंक

: M.Sc.
 : IV
 : Chemistry
 : Medicinal Chemistry

OPT-5 (Code- MCH-515)
 : Optional
 : 50

Particulars / विवरण

Unit-1	Structure and activity : Relationship between chemical structure and biological activity (SAR), Receptor Site Theory. Approaches to drug design. Introduction to combinatorial synthesis in drug discovery. Factors affecting bioactivity. QSAR-Free-Wilson analysis. Hansch analysis, relationship between Free-Wilson analysis and Hansch analysis.
Unit-2	Pharmacodynamics: Introduction, elementary treatment of enzymes stimulation, enzyme inhibition, sulfonamides, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry.
Unit-3	Antibiotics and antibacterials Introduction, Antibiotic β -Lactam type - Penicillins, Cephalosporins, Antitubercular - Streptomycin, Broad spectrum antibiotics - Tetracyclines, Anticancer - Doxorubicin (Actinomycin D)
Unit-4	Antifungal - polyenes, Amphotericin B, Griseofulvin, Itraconazole, Voriconazole, Caspofungin, Echinocandins, Antimicrobial + Ciprofloxacin, Norfloxacin, Antiviral - Acyclovir Antimalarials : Chemotherapy of malaria. SAR. Chloroquine, Chloroquine and Mefloquine
Unit-5	Non-steroidal: Anti-inflammatory Drugs : Diclofenac Sodium, Ibuprofen and Netopam Antihistaminic and antiasthmatic agents : Terfenadine, Cinnarizine, Salbutamol and Beclomethasone dipropionate.

Recommended

1. Introduction to medicinal chemistry, A. Gringunge, Wiley-VCH.
2. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Ed Robert F Dorge.
3. An Introduction to Drug Design, S.S. Pandeya and J.R. Dimmock, New Age International.
4. Burger's Medicinal Chemistry and Drug Discovery, Vol-1 (Chapter 9 and Chapter 14), Ed. M.E. Wolff, John Wiley.
5. Goodman and Gilman's Pharmacological Basis of Therapeutics, Mc Graw-Hill.
6. The Organic Chemistry of Drug Design and Drug Action, R.B. Silverman, Academic Press.
7. Strategies for Organic Drug synthesis and Design, D. Lednicer, John Wiley.
8. Principles of Medicinal Chemistry W.O. Foye
9. Medicinal Chemistry; The Role of organic chemist in Drug Research, S.M. Roberts and L. Pricer.

Feb 2011
 R.M.
 M.D.
 21/10/20

Department of Higher Education, Govt. of M.P.
 Post Graduate Semester wise Syllabus
 as recommended by Central Board of Studies and approved by the Governor of M.P.
 एम.पी. उच्च शिक्षा विभाग, म.प्र. शासन
 कक्षातंत्रातील प्रशासकीय कामांसाठी अनुसंधान प्रकल्प
 अर्थीय अनुसंधान समितीद्वारे अनुमोदित तथा म. प्र. के. राज्यालय द्वारा अनुमोदित
 Session (सत्र) 2010-2011

Approved
 02/9/20

RL
 2-9-2020

Chemistry
 Part No. 1
 Part No. 2

Max Marks - 34

13
12
04
05
34

RL
 12/11/2020
 25/11/20

Determination of PKa of an indicator (e.g. methyl red) in (a) aqueous and (b) micellar media.
 Determination of stoichiometry and stability constant of Ferricisothiocyanate complex ion in solution.
 Determination of rate constant of alkaline bleaching of Malachite green and effect of ionic strength on the rate of reaction.

RL
 11/11/20
 02-11-20

Kinetics

Determination of rate constant and formation constant of an intermediate complex in the reaction of $Co(NH_3)_6^{3+}$ and Hypophosphorous acid at ambient temperature.
 Determination of energy and enthalpy of activation in the reaction of $KMnO_4$ and benzyl alcohol in acid medium.
 Determination of energy of activation of and entropy of activation from a single kinetic run.
 Kinetics of an enzyme catalyzed reaction.

Supriya Rai
 25/11/20

Thermodynamics

Determination of partial molar volume of solute (e.g. KCl) and solvent in a binary mixture.
 Determination of the temperature dependence of the solubility of a compound in two solvents having similar intramolecular interactions (benzoic acid in water and in DMSO water mixture and calculate the partial molar heat of solution).

RL
 25/11/20

Spectroscopy

Qualification and estimation of metal ions such as Cd^{+2} , Pb^{+2} , Zn^{+2} , and Li^{+2} etc. polarographically.
 Study of a metal ligand complex polarographically (using Lingane's Method).

RL
 25/11/20

Suggested

Inorganic Experiments, J. Derek Woolings, YCH.
 MacInnes Inorganic Chemistry, Z. Szafran, R.M. Pike and M.M. Singh, Wiley.
 Analytical Inorganic Chemistry, G. Marr and B. W. Rockett, Van Nostrand.
 The systematic Identification of Organic Compounds, R.L. Shriner and D.Y. Curtin.

Department of Higher Education, Govt. of M.P.
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 उच्च शिक्षा विभाग, म.प्र., ग्वाल्जर
 स्नातकोत्तर स्तरावरी के लिये सेमेस्टर अनुसार पाठ्यक्रम
 अखिल भारतीय मण्डल द्वारा अनुमोदित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित
 Session (सत्र) 2010-2011

Ajmal
 22/9
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Riv
 2-9-2020

Inf
 2/11/2020

Ullas
 02/9/20

Supriya
 2/11/20

Supriya
 2/11/20

Ajmal
 2/11/20

Synthesis of Organic Compounds
 Spectrophotometric Determinations

Max Marks - 33

12
12
04
05
33

Synthesis of Organic Compounds

should illustrate the use of organic reagents and may involve purification of the products by
 techniques. Photochemical reaction Benzophenone \rightarrow Benzpinacol \rightarrow Benzpinacolone
 rearrangement : Benzanilide from benzene Benzene \rightarrow Benzophenone \rightarrow Benzphenone oxime
 Benzilic acid rearrangement : Benzilic acid from benzoin Benzoin \rightarrow Benzil \rightarrow Benzilic acid
 heterocyclic compounds Skraup synthesis ; Preparation of quinoline from aniline Fisher Indole
 Preparation of 2-phenylindole from phenylhydrazine. Enzymatic synthesis Enzymatic synthesis
 reduction : reduction of ethyl acetoacetate using Baker's yeast to yield enantiomeric excess of S
 hydroxybutanoate and determine its optical purity. Biosynthesis of ethanol from sucrose.
 microwave Alkylation of diethyl malonate with benzyl chloride. Synthesis using phase
 Alkylation of diethyl malonate or ethyl acetoacetate with an alkylhalide.

of organic compounds by the analysis of their spectral data (UV, IR, PMR, CMR & MS)
 Estimations/isolation of the following (any one compound)

Estimation

- acids
- carbohydrates
- lactic acid
- etc

- from milk
- from tomato
- from black pepper
- from tea leaves
- from milk

Ajmal
 2/11/20