THE MADURA COLLEGE (Autonomous), MADURAI – 625 011

(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)

RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : M.Sc., Chemistry **COURSE CODE : 1PGC1 (Upto 2016)**

COURSE TITLE : Organic Chemistry - I **QN.NO : 2102**

TIME : 3 Hours **MAX.MARKS :75**

UNIT 1

(a) Electron Displacement: Inductive and field effects, resonance and hyperconjugation influence of electronic effects on dissociation constants of acids and bases-concept of HSAB; Steric inhibition of resonance.

(b)Energetics and investigation of mechanism:

Reaction intermediates – Transition state theory, Thermodynamic and kinetic control of Organic reactions – Energy diagrams for the single, multistep and catalysed reactions. Hammond 's postulate, principle of microscopic reversibility , kinetic and non-kinetic

methods for investigation of reaction mechanism.

(c) Hydrolysis of esters: BAc^2, AAc^2 AAc^1 , AAl^1 mechanisms.

UNIT 1I

(a) Aliphatic Nucleophilic Substitution : SN^1 , SN^2 and SNi mechanisms, Stereochemistry; Effect of substrate structure, nucleophile, nature of leaving group, solvent ; ambident nucleophiles; neighbouring group participation; Substitution at Allylic and vinylic carbons.

(b) Aromatic Nucleophilic Substitution

Uni & Bimolecular mechanisms (SNAR), Benzyne intermediate mechanism, Von-Richter

Reaction, Homolytic Aromatic Substitution; Ziegler alkylation, Chichibabin reaction.

(c) Vitamins – Structure, synthesis and physiological action of vitamins A, B1, B2, B6, B12 (structural features only), C, E, H and K.

UNIT I1I

(a) Aromatic Electrophilic substitution : Mechanism for mono substitution- pi and Sigma complex intermediates -nitration, sulphonation, halogenation, Friedel-Crafts alkylation, acylation ,formylation ; mechanism of disubstitution orientation & reactivity in mono-substituted benzenes, o- p- directing groups ; Ipso substitution- partial rate factors.

Quantitative treatment of effect of structure on reactivity – Hammett relationship

Significance of reaction and substituent constants, application, limitation and deviation.

(b) Aliphatic Electrophilic substitution SE 1 , SE 2 & SE i mechanism

c) Terpenes :Structure stereochemistry & synthesis of camphor,zingiberene, cadinene, Santonin, abietic acid.

UNIT IV

(a) Addition to multiple bonds: Electrophilic , nucleophilic and free radical additions-stereoselectivity -syn and anti additions – Mechanisms of- homogenous hydrogenation (Wilkinson' catalyst), hydroboration, epoxidation with per acid; hydroxylation with potassium permanganate and osmium tetroxide , Birch reduction,; addition to conjugate dienes ; Stork enamine reaction

(b) Reactions of carbonyl group : aldol, Claisen and benzoin condensations, Perkin, Knoevenagel, Mannich, Cannizaro, Wittig reactions; Wolff –Kishner and MPV reductions ; reduction with lithium aluminium hydride, sodium borohydride.

Addition to α, β- unsaturated carbonyl groups: addition of Grignard reagent, Michael addition, Diels-Alder reaction;

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PROGRAMME : M.Sc., Chemistry **COURSE CODE : 1PGC2 (Upto 2016)**

COURSE TITLE : Inorganic Chemistry - I **QN.NO : 2104**

TIME : 3 Hours **MAX.MARKS :75**

UNIT-I

a) Classificcation of solvents, properties of ionizing solvents , Tppical reactions in non-aqueous solvents - liquid HF. HCN, H_2SO_4, CH_3COOH, DMF, DMSO only.

b) Ionic bond : Lattice energy and its determination by Born-Haber cycle and other application of BHC, Born-Lande & Born–Meyer equations, significance of Madelung constant - hardness, electrical conductivity and solubility of ionic compounds - Different types of electrostatic interaction, hydrogen bond.

UNIT-II.

Covalent bond: Qualitative treatment of valence bond & molecular orbital theories - Sigma and Pi bonds - Hybridization & resonance. Calculation of s and p character – Bent's rule. Application of VB & MO theories to the structures of homo nuclear and heteronuclear diatomic and selective triatomic and polyatomic molecules (BeH_2, $BeCl_2$, CO_2, H_2O, NO_2 and CO_3^{2-} only) - Comparison of VB & MO theories. Walsh diagram and its uses. Bond properties - bond order, bond energy, bond length and bond polarity. Electron pair repulsion theory and its applications.

UNIT-III

Polyacids-isopolyacids and heteropoly acid of vanadium, chrominum, molybodenum and tungsten. Silicates: occurrence - principles of silicate structures, classification of silicates: orthosilicates, pyrosilicates, cyclic silicates, chainsilicates, sheet silicates and 3 dimenesional silicates. Structure -property correlations, preparation of organosilicon compounds, silicones, metal clusters-chemistry of low molecularity metal clusters - metal-metal bonds.

UNIT-IV

The concepts of multicentre bond as applied to electron deficient molecules-boron hydrides-metal alkyls. Preparation, properties and structure of boron hybrides-diborane - carboranes- Metallocarboranes- higher borane, borides, boron-nitrogen compounds, borazine, boron nitride. P-N compounds-phosphazenes, polyphosphazenes-polythiazyl, S-N compounds-S_4N_4, Si-O compounds – Siloxanes, polysiloxanes

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PROGRAMME : M.Sc., Chemistry **COURSE CODE : 1PGC3 (Upto 2016)**

COURSE TITLE : Physical Chemistry - I **QN.NO : 2106**

TIME : 3 Hours **MAX.MARKS :75**

UNIT I: CHEMICAL THEORMODYNAMICS

Thermodynamic equations of state - derivation and application to real gases in the calculations of (dH/dp)T,(dE/dv)T and $\mu_{J.T}$ etc. Thermodynamics of systems of variable composition - partial molar quantities Gibbs - Duhem equation - chemical potential - variation of chemical potential with T and P-Thermoynamic properties of real gases - fugacity - determination of fugacity - compressibility curves and fugacity - variation of fugacity with temperature - fugacity of a component 'fi' in a real gas mixture- activity for gas, solid and liquid systems-Lewis-Randall rule- formulation (Planck,Lewis - Randall), unattainability of absolute zero -calculation of absolute entropies - apparent exceptions to the third law.

UNIT II : GROUP THEORY

Symmetry elements and symmetry operations- mathematical group and group multiplication table of point groups- determination of point group of a molecule – matrix multiplication and Inverse of matrix and diagonalization- matrix representation of symmetry operation- representation of a group-reducible and irreducible representations-the great orthogonality threom– characteristic table for C_{2V},C_{3V}, D_{nd} and D_{nh} point groups- direct product representation – vanishing integrals- group theoretical analysis of IR and Raman active vibration of typical molecules- symmetry selection rules for IR, Raman and electronic spectra- Eeectronic spectra of ethylene and formaldehyde- applications of group theory.

UNIT III : CHEMICAL EQUILIBRIUM AND PHASE RULE

Reaction free energy - reaction potential- reaction isotherm an direction of spontaneity standard free energy of reaction its calculation from thermo chemical electro chemical and equilibrium data - temperature coefficient of reaction free energy and equilibrium constant. Three component systems - systems with three liquids - those involving one, two and three partially miscible liquid pairs-systems involving two salts and water- Schrein-makers wet residue method - isothermal evaporation-transition point for double salt formation.

UNIT IV : NON-EQUILIBRIUM THERMODYNAMICS

Phenomenological laws and Onsager's reciprocal relations-entropy product- ion specific examples of entropy production - Prigogine's principle of minimum entropy production - entropy production in coupled phenomena-an elementary introduction to bioenergetics.

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PROGRAMME : M.Sc., Chemistry **COURSE CODE : 1PGC4 (Upto 2016)**

COURSE TITLE : Analytical Chemistry **QN.NO : 2107**

TIME : 3 Hours **MAX.MARKS :75**

UNIT-I: ANALYTICAL CHEMISTRY

Oxidation and Reduction

Electrode potential-use of redox potentials in the interpretation of chemical behavior, EMF diagrams, Frost and Pourbaix diagrams and their interpretations. Analytical chemistry :- Redox indicators and redox titration, Amperometric titrations - theory – apparatus - types of titration curves, successive titration curves, applications; Cyclic voltammetry - theory and - applications to inorganic systems.

Complexometric Titrations

Chelating agents-types of EDTA titrations-direct and back titrations-replacement titrations-masking and demasking agents.

UNIT-II Thermal analysis and magneto chemistry

Thermograivmetry; Differential thermal analysis & Differential scanning, calorimetry - applications to inorganic compounds &Complexes. Optical rotary dispersion and Circular Dichroism : Rotational strength of the Chromophores - Cotton effect - Selection rules - its appilication to D_3 Complexes - the use of ORD & CD in determination of the structure and configuration of the metal complexes. Magnetochemistry - magnitude of magnetic moments - experimental determination - Faraday Guoy & NMR methods - The concept of the quenching of orbital momentum - Magnetic properties of A,E & T terms - effect of spin - orbit coupling - T.I.P.

Antiferromagnetic interactions in di and poly nuclear transition - metal complexes & solids. The magnetic behavior of lanthanides and actinides

UNIT-III Chromatography and AAS

Gas-liquid chromatography-principles - retention volume, instrumentation-carrier gas-column - preparation-stationary phase-detector- Thermal conductivity - flame ionization-electron capture - applications of GLC. High performance liquid chromatography-Scope-column efficiency-instrumentation-column packing detectors - Applications of atomic absorption spectroscopy-atomizer - flame and electrothermal radiation-instrumentation-spectral and chemical interferences - applications of AAS.(Qualitative analysis-Quantitative analysis-calibration curves simultaneous multicomponent analysis - determination of metallic elements in biological materials - determination of metallic elements in industrial food products-determination of Ca, Mg, Na and K in blood serum. Principles and applications of colorimetry and spectrophotomery, fluorimetry, nephelometry and turbidimetry.

UNIT-IV Electroanalytical methods

Direct potentiometry – acid base , precipitation and complexometric titrations – Voltametry – polorographic analysis - experimental conditions – quantitative determination – calibration methods and standard addition method – Determination of equilibrium constant for complex formation. Advanced voltametric techniques – rapid scan techniques – AC techniques – Stripping techniques, Coulometry – primary coulometry and secondary coulometry – controlled current , controlled potential coulometry – Amperometry- Amprometric sensors-Chronomethods- Chronoamperometry , chronopotentiometry and chronocoulometry. Electrogravimetry - theory of elecroanalytical techniques. Method of electrogravimetry – constant current electrolysis-controlled potential electrolysis, internal electrolysis - determination of bearing metal – electrolytic separation and determination of copper and nickel.

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PROGRAMME : M.Sc., Chemistry **COURSE CODE : 2PGC1 (Upto 2016)**

COURSE TITLE : Organic Chemistry - II **QN.NO : 2152**

TIME : 3 Hours **MAX.MARKS :75**

Stereochemistry

Introduction to molecular symmetry and chirality – examples from common objects to molecules – axis, plane, center, alternating axis of symmetry. Stereoisomerism – definition based on symmetry and energy criteria – configuration and conformational stereoisomers. Center of chirality – molecules with C, N, S based chiral centers – absolute configuration - enantiomers – racemic modifications - R and S nomenclature using Cahn-Ingold-Prelog rules – molecules with a chiral center and Cn – molecules with more than one center of chirality – definition of diastereoisomers – constitutionally symmetrical and unsymmetrical chiral molecules - erythro, threo nomenclature – E and Z nomenclature – out/in isomers.

Axial, planar and helical chirality – examples – stereochemistry and absolute configuration of allenes, biphenyls and binaphthyls, ansa and cyclophanic compounds, spiranes, exo-cyclic alkylidenecycloalkanes.

UNIT II
stereochemistry – II

a) Asymmetric synthesis : The concept of prochirality-topocity-prostereoisomerism – equivalent, enantiotopic, diastereotopic ligands- atropisomerism-enantiomeric excess and diasteromeric excess, methods to determine these values – classification of symymmetric synthesis based on chiral substrate, chiral auxillary, chiral reagent and chiral catalysis- Cram's rule and Prelog's rule- sharpless asymmetric epoxidation

b)Chiro optical properties
Circularly polarised light-optical rotation –optical rotatory dispersion-circular birefringence, circular dichroism-plain curves, cotton effect-comparison of ORD and CD; alpha haloketone rule, octant rule Applications in stereo chemical problems

c) Conformational Analysis

Conformational analysis of acyclic and cyclic systems – substituted n-butanes – cyclohexane and its derivatives – decalins –fused and bridged bicyclic systems – conformation and reactivity some examples - Curtin-Hammett principle.

UNIT III

(a) **Aromaticity** : Concept- criteria-H?ckel's rule, Craig's rule, NMR spectra; Non, homo- and anti aromatic systems; Alternant and non-alternant hydrocarbons; Non-benzenoid aromatic compounds-Azulene,Ferrocene, Tropolone , Sydnones, and Annulenes

(b) **Heterocyclic compounds**: Preparation , properties and reactions of pyrazole, thiazole, carbazole,imidazole, indole, pyrimidine and acridine

(c) Purines : Structure & synthesis of uric acid, adenine,caffeine & theobromine

(d) **Free radicals**: Formation, detection and stability of free radicals-Hunsdiecker, Gomberg, Sandmeyer, Ullmann and Pschorr reactions

UNIT IV

Newer reagents in Organic synthesis : Use of following reagents/reactions in organic synthesis and functional group transformations: K-selecteride and L-selecteride, sodium cyanoborohydride, super hydrides, 9-BBN, IBX, Dess-Martin periodinane, manganese dioxide, Fetizon reagent, dioxiranes, ceric ammonium nitrate, Gilman's reagent, lithium disopropylamide, dicyclohexylcarbodimide, trimethysilyl iodide, trin-butyltin hydride, Tebbe reagent, Corey-Nicolaou reagent, Peterson's synthesis, baker's yeast, lipase, Mosher's reagent, use of Os, Ru, and Tl reagents and DDQ.

Text Books:

1. Stereochemistry of organic compunds-E.L.Eliel,Mc GraHill -Reversed edition
2. Hertocyclic chemistry-Joule & Smith-(E.L.B.S)
3. Organic chemistry-I.L.Finar-Vol II
4. Reaction mechanism in organic chemistry - S.M. Mukerje & Singh
5.. Advanced Organic Chemistry - Jerry March

References

1. O.R.D and C.D in organic chemistry-P.craabe, Golden day publiction(1965)
2. Optical rotatory dispersion C.Dgerassi-McGrawHill
3. Stereochemistry of organic compounds-Principles and application D.Nasipuri-Wiley Eastern Ltd -1992
5 Sterochemistry -P.S.Kalsi-Wrley Eastern
6. Problems in stereochemistry-P.S.kalsi-Wrely eastern
7. Stereochemistry-Kurt mislow-Benjamin inc.N.Y
8. Stereochemistry-V.M.Potapov -Mir publication-Moscow
9. Organic stereochemistry-A.Kagan-E.Arnold
10. Steric effects in organic chemistry-Newman-wrley eastern.
11. Conformation analysis-Allinger-Angyal &morison wrley
12. Carbohydrates-Dyke-Academic press
13. Chemistry of hetrocyclic compounds-Acheson-Wiley Eastern 1973
14. Chemistry of heterocyclic compounds -G.M.Badger
15. Organic chemistry-Morrison and Boyd -V edn-Prentice Hall
16. Molecular rearrangements - P. DeMeyo

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : M.Sc., Chemistry **COURSE CODE : 2PGC2 (Upto 2016)**

COURSE TITLE : Inorganic Chemistry -II **QN.NO : 2154**

TIME : 3 Hours **MAX.MARKS :75**

UNIT-1

The nature of the metal-ligand bond-Qualitative aspects of the valence bond theory-The crystal field approximation-The qualitative aspects-The quantitative treatment-The expansion of crystal field potential-The calculation of the matrix element for the d^1 case-The tetragonal systems(a brief mention)-Crystal field splitting in octahedral, tetrahedral, square pyramidal, trigonal bipyramidal and square planar geometries-Consequences of crystal field splitting on thermo dynamic, magnetic and spectroscopic properties. The molecular orbital theory-Octahedral, tetrahedral and square planar geometries-A general note on the semi empirical calculations. Experimental evidences for covalence in metal-ligand bonding, the inadequacy of CFT.

UNIT-II

Electronic Spectroscopy: oscillator strengths, transition moment integral Selection rules based on group theoretical considerations - A detailed survey of the electronic spectra of octahedral, tetrahedral and square planar complexes of transition metals-(i) effect of spin orbit coupling ii) Jahn-Teller distortions and its effect on the structure and spectrum The spectrochemical series and its basis, the nephelauxetic effect and the nephelauxetic series-Calculation of Dq,B,C from the spectrum. Orgel and Tanabe-Sugano diagrams and their use in calculating the parameters Dq & β.The charge transfer spectra of complexes-ligand to metal, metal to ligand types- Photoelectron spectroscopy (XPS and UPS) : Ionic states, selection rule photon source-electron analyzers-assignment of bands-the Koopmann's theorem -its use and limitations-symmetry considerations - fine structure, bandwidth-relative intensities-chemical shift in X-ray photoelectron spectroscopy-applications.

UNIT-III Nuclear magnetic resonance

^{1}H, ^{13}C, ^{19}F and ^{31}P – NMR. Applications to inorganic compounds - NMR of paramagnetic complexes. Contact interactions - pseudo contact interactions- Spin-density distributions in metal complexes-structures of metal complexes-shift reagents- dynamic aspects of NMR. Electron spin resonance: Spin-Hamiltonian, ESR phenomenon -hyperfine interactions-spin-orbit coupling- application to inorganic compounds - ESR spectra of D and F states in octahedral fields (Zero field splitting and Kramers degeneracy)- determination of the ground states of complexes.
concept of effective spin.

Contd . . . 2

UNIT-1V

Vibrational spectroscopy : Band assignment- symmetry analysis of vibration - the normal modes- selectic rules for infrared and Raman based on group theoretical consideration - Electronic Raman spectrum ar its applications-structure of some simple molecules from IR and Raman spect (NSF_3,SOF_2,N_2O_4,ClF_3,H_2O,NH_3,BCl_3, SF4 etc). Infrared and Raman spectrum of metal complexes Analysis of CO stretching frequencies in $M(CO)_6$, cis & trans $M(CO)_4$ L_2 . Mössbauer spectroscop Discovery - Nuclei suitable for Mössbauer experiment - Hyperfine interactions – isomer shifts quadrupo splitting & magnetic hyperfine splittings - temperature effects - applications Mössbauer spectroscopy to compounds & complexes of Fe & Sn particularly to complexes of Fe biological importance.

Text Books:

1. Inorganic Chemistry - K. Purcell and J.C. Kotz
2. Coordination compounds- S.F.A. Kettle
3. Physical methods in chemistry - R.S. Drago - W.B.Saundar 1977
4. Advanced inorganic chemistry - Cotton & Wilkinson - V Edt John - Wiley

Reference

1. Introduction to ligand field theory - C.J. Ballhausen- Mc GrawHill
2. Introduction to ligand fields -B.N. Figgis - John Wiley
3. Some aspects of crystal fields theory - Thomas M. Dunn & McClure & Pearson Harper-Row
4. Molecular orbital theory -C.J. Ballhansen & Hzry. B. Grey
5. Chemical applications of group theory - F.A. Cotton
6. Inorganic electronic Spectroscopy - A.B.P. Lever- Elsvier II Edn.
7. Electonic spectra of metal complexes - D. Sutton- McGraw-Hill
8. Transition metal chemistry - B.N. Figgis -IX Mercel-Dekker
9. Advanced Inorganic Chemistry - Iill and Day- John wiley.
10. Structural methods in Inorganic chemistry - E.A. Ebsworth - ELBS
11. Magnetism & transition metal complexes Mobbe and Machin.
12. Spectrocopy -Walker and Straughan volume I, II & III Chapmen-Hill.
13. Electron spin resonance – Martin- Siemens
14. Inorganic spectroscopy - CNR Rao & Feraro- vol. I&II - Academic Press.
15. Magnetic Resonance - Carrington
16. Theory and application of molecular paramagnetism - F.A. Boudreaux & L.N. Muley - John Wiley
17. Infrared and Raman Spectra of Inorganic & Coordination Compounds - Nakamoto Wiley Interscience IV Edn.
18. Mossbauer Spectroscopy - A. Vertes & K. Burger- Elsevier
19. Mossbauer Spectroscopy - T.C. Gibbs - Chapman - Hall
20. NMR, NQR, EPR and Mossbauer Spectroscopy in inorganic chemistry by R.V. Parish.
21. Introductory Raman Spectroscopy., Second Edition, John R. Ferraro, Kazuo Nakamoto and Chris W.Brown
22. Bioinorganic Chemistry, Lippard, Grey and Bartini.

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME: M.Sc., Chemistry **COURSE CODE : 2PGC3(Upto 2016)**

COURSE TITLE : Physical Chemistry - II **QN.NO : 2156**

TIME : 3 Hours **MAX.MARKS :75**

UNIT – I

QUANTUM CHEMISTRY I

(i) Introduction to quantum chemistry (ii) Application of SWE to simple systems: Postulates of quantum mechanics-operators - linear, Hermitian method of getting quantum mechanical operators eigenfunctions, eigenvalues expansion theorem-orthogonality and normalization of wave functions - commuting and non commuting operators-Schrödinger time - independent wave equation. term symbols – LS and J-J coupling - Quantum mechanics of some simple systems - free particle - particle in a box with infinite walls - particle in a box with finite walls - rigid motor - rigid rotor in a plane - Harmonic oscillator - concept of zero point energy

UNIT – II

QUANTUM CHEMISTRY II

Approximation methods Hydrogen atom problem - continuous spectrum of hydrogen - need for approximation methods - perturbation method - first order perturbation- energy variation method - application of first order perturbation theory and variation method to the ground state of 'He' atom - electron spin and Pauli's principle – anti symmetric nature of the wave functions. Hartree - Fock self-consistent field method - applications to 'He' atom application of molecular - orbital theory to hydrogen molecular ion, ethylene, benzene - butadiene(LCAO method) - concept of hybridization.

UNIT III:

CHEMICAL KINETICS I

Theories of Reaction Rates: Collision theory bimolecular gaseous reactions - activation energy and the potential energy surfaces - kinetic isotope effect - absolute reaction rate theory (ARRT) of simple unimolecular and bimolecular elementary gas phase reactions - Thermodynamic formulation of ARRT - statistical mechanical approach to ARRT - Free energy , enthalpy and entropy of activation - probability steric factor and entropy of activation-transmission coefficient-theories of unimolecular reactions - Lindemann, Hinshelwood treatments- RRKM - Rice - Rampsberger - Kassel Theory of unimolecular reactions - Marcus approach.

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2PGC3 (...)

UNIT IV:

CHEMICAL KINETICS II

(i) **Chain reactions:** general characteristics, kinetics of chain reactions - steady state approximation - $H_2 - Br_2$ – reaction, Rice - Herzfeld mechanisms for the decomposition of ethane and acetaldehyde General characteristics of branched chain reactions explosion limits - H_2-O_2- reaction
(ii) **Fast reactions:** flow technique - continuous and stopped flow methods - relaxation methods - pressure - jump and temperature - jump methods. Ultrasonic absorption technique – crossed molecular beam dynamics – salient features, experimental technique, study of reactive collision.

Text Books:

1. Quantum Chemistry, D. A. McQuarrie,2nd edn.,University Science Books, 2008
2. Introductory quantum chemistry - A.K. Chandra, 4thedn., TataMcGraw-Hill, New Delhi, 1994.
3. Quantum chemistry - R.K. Prasad, Wiley, Eastern Ltd., New Delhi, 1992.
4. Chemical kinetcs: - K.J. Laidler, 3rd edn., Harper and Raw; 1987.

References

1. Quantum chemistry – H.EYRING, J.WALTER and G. KIMBALL. Wiley 1944.
2. Notes on molecular orbital calculations - J.DD. ROBERTS.
3. Physical chemistry - P.W. ATKINS(GENERAL TEXT)
4. Kinetics & mechanism - A.A. Frost & R.G. Pearson, 2nd edn., Wiley 1961.
5 Chemical kinetics - Nicholas. J.E., Wiley 1976.

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : M.Sc., Chemistry **COURSE CODE : 2PGC4 (Upto 2016)**

COURSE TITLE : Medicinal Chemistry **QN.NO : 2158**

TIME : 3 Hours **MAX.MARKS :75**

UNIT- I

Concept of drug, lead compound and lead modification, prodrugs and soft drugs; Structureactivity relationship (SAR), quantitative structure-activity relationship (QSAR); Factors affecting bioactivity – resonance, inductive effect, isosterism, bio-isosterism, spatial considerations; Theories of drug activity – occupancy theory, rate theory, induced fit theory Concept of drug receptors – elementary treatment of drug-receptor interactions; Physicochemical parameters – lipophilicity, partition coefficient, electronic ionization constants, steric, Shelton and surface activity parameters and redox potentials; Factors affecting modes of drug administration, absorption, metabolism and elimination; Significance of drug meta-bolism in medicinal chemistry.

UNIT- II

Antibiotics

Cell wall biosynthesis, inhibitors of β-lactam rings, antibiotics inhibiting protein synthesis; Isolation, structure elucidation, synthesis, SAR and mode of action of penicillins; Synthesis of penicillin G, penicillin V, ampicillin, amoxicillin and cephalosporin.

Isolation, structure elucidation, synthesis, SAR and mode of action of following antibiotics: streptomycin, tetracyclines and chloroamphanicol.

UNIT- III

Drug Types - I

*(a) Antineoplastic drugs***:** Cancer chemotherapy, role of alkylating agents and antimetabolites in the treatment of cancer; Carcinolytic antibiotics and mitotic inhibitors; Synthesis of mechlorethamine, melphalan, 5-bromouracil and 6-mercaptopurine; Anticancer action of cisplatin and taxol.

*(b) Cardiovascular drug***:** Classification, synthesis and mode of action of quinidine, verapamil, methyldopa and buphenine.

*(c) Hypnotics and sedatives***:** SAR and mode of action; Synthesis of diazepam, oxazepam, chlorazepam, alprazolam, barbiturates, thiopental sodium.

*(d) Local anaesthetics***:** Classification, SAR and mode of action; Synthesis of procaine, α-eucaine and β-eucaine, xylocaine, cinchocaine and quinisocaine.

Contd . . . 2

UNIT- IV

Drug Types - II

*(a) Antiinfective drugs***:** Mode of action and synthesis of sulphonamides, furazolidone, ciprofloxacin, norfloxacin, daspone, isoniazide.

*(b) Antipyretic Analgesics***: C**lassification and mode of action of antipyretic analgesics; Synthesis of paracetamol, chincophan, Novalgin and mefenamic acid.

*(c) Antihistamines***:** SAR and mode of action of H1-receptor antagonists; Synthesis of bromazine, mepyramine, methapyriline, antazoline, promethazine and phenindamine.

*(d) Antimalarial drug***:** Nitrogen heterocycles as antimalarial agents, their classification and mode of action, synthesis of chloroquine, pamaquine, primaquine, Mepacrine and pyrimethamine. Introductory idea on Artemisinin, artemether and arteether.

Text Books

1. Burger. *Medicinal Chemistry and Drug Discovery*, Vol-1, Ed. M. E. Wolff, John Wiley (1994).
2. Goodman & Gilman. *Pharmacological Basis of Therapeutics*, McGraw-HilI (2005).
3. S. S. Pandeya & J. R. Dimmock. *Introduction to Drug Design*, New Age International.(2000).
4. D. Lednicer. *Strategies for Organic Drug Synthesis and Design*, John Wiley (1998).
5. Graham & Patrick. *Introduction to Medicinal Chemistry* (3rd edn.), OUP (2005).

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THE MADURA COLLEGE (AUTONOMOUS) MADURIA – 11
(Affiliated by Madurai Kamaraj University)

Class : M.Sc., (CHEMISTRY) Sub.Code : 3PGC1

Title : ORGANIC CHEMISTRY-III Qn.No. : 2166

Time : 3 Hours Max.Marks : 75

Credits : 4

UNIT I

SPECTROSCOPY I

(a) **UV Spectroscopy** : Principle- types of electronic excitation, Woodward-Fieser rules for conjugated polyenes, enones, Scott rules for some substituted aromatic compounds; factors affecting the position and intensity of lambda -structure, solvent and shift reagents
(b) **IR Spectroscopy**: Vibrational frequency- Factors affecting the group frequencies - hydrogen bonding, electronic and steric effect, Fermi resonance –finger print region, FT-IR
(c) **Mass Spectrometry**: Principle-types of ions –molecular, isotopic, metastable; Base peak; Nitrogen rule; Fragmentation modes of various class of compounds; Retro Diels-Alder reaction, McLaffety rearrangements

UNIT II

SPECTROSCOPY II

(a) **^{1}H NMR spectroscopy**: Principle - TMS as internal standard-Relaxation process - Chemical shift-nmr scales; Number, intensity & position of signals - Factors affecting the chemical shift ; spin-spin coupling, coupling constant; spin-spin splitting-lanthanide shift reagents, Proton exchange, deuterium exchange and the influence of restricted rotation
(b) **^{13} C NMR spectroscopy** : Basic principle of FT technique - Relaxation time, assignment of signals; Off-resonance decoupling- double resonance-spin tickling, Nuclear-Overhauser Effect and CIDNP; DEPT ^{13}C spectra, INADEQUATE, COSY, HETCOR, ROESY, NOESY and TOCSY- ^{13}C-^{13}C CORRELATION

UNIT III

Pericyclic Reactions :Classification, electrocyclic, cycloaddition, sigmatropic, Chelotropic and ene reactions. Application of symmetry to orbital interactions- Explanation of these reactions in terms of correlation diagram, FMO approach,- Woodward-Hofmann rules, Huckel-Mobius approach, Dewar-Zimmermann approach.

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UNIT IV

(a) **Photochemistry** : n to pi* and pi to pi * transitions-allowed and forbidden; Jablonski diagram; Internal conversion, inter system crossing, fluorescence and phosphorescence. Photo chemical reactions of ketones, photoreduction, Norish type I & II reactions; photosensitisation; Paterno-Buchi reaction, Barton reaction, Photo oxidation. Photochemistry of alkenes- Photochemical isomerisation, addition and substitution- Photo-Cleavages

b) **Molecular Rearrangements**: Classification-nucleophilic, electrophilic and free radical rearrangements-Mechanisms of Wagner-Meerwein, Demjanov, Favorskii,Stevens, Benzidine, Fries, Curtius ,Schmidt, Dienone-phenol and di-pi-methane rearrangements

Text Books

1. Spectroscopic methods in organic chemistry Williams and Fleming-Mc Grawhill-1988
2. Spectroscopic identification of organic compounds, Silverstein,Basseler and Morrill-John wiley
3. Photo Chemistry and Molecular reactions Dupvy and Chapman
4. Photo Chemistry - Singh & Mukherjee

References

1. Application of absorption spectroscopy of organic compounds John Dyer-Printice Hall
2. Text Book of organic chemistry-Morrison & boyd V edition
3. organic spectroscopy-W.kemp-E.L.BS 1979
4. G.R. Barrow -Introduction to molecular spectroscopy, (Theoretical treatment) Mc GrawHill
5. C.N.R rao-ultra viloet and visible spectroscopy -Bulletworths london(1975)
6. K.nakanishi-Infrared absorption to spectroscopy-holden day
7. N.M.R and chemistry -W.Kemp
8. Interpretation of C-13 NMR spectra-F.W.Wehril and T.Withlin, Heydon,London 1976
9. C-13 NMR for organic chemistry-Levy and Nelson-Wiley , Interscience N.Y. 1972
10. Pulse and fourier transform N.M.R-Farrar and Becker - Academic Press 1971
11. Organic absorption Spectroscopy-Y.R.Sharma
12. Spectroscopy-B.K.Sharma-Goel publishing house, Interpretation of mass spectra-Mc Lafferty University science book, Mill valkey.california- 1980
13. Pericyclic Reactions - Gill and Wills
14. Organic Chemistry - (6-th edn) I.L.Finar
15. Advanced Organic Chemistry - Jerry March
16. Organic Reaction mechanism - Singh & Mukherjee
17. Photo chemistry -N.J.Turro

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : M.Sc., Chemistry **COURSE CODE : 3PGC2 (Upto 2016)**

COURSE TITLE : Inorganic chemistry - III **QN.NO : 2168**

TIME : 3 Hours **MAX.MARKS :75**

UNIT – I

a) Stability of complexes - thermodynamic aspects of complex formation - factors affecting stability constants. Determination of stability by potentiometric, polarographic and spectrophotometric methods - stabilization of both high and low oxidation states through complex formation - The concept of hard and soft acids and bases and its applications in predicting the stabilities of complexes of transition metals.
b) The chemistry of lanthanides and actinides Oxidn states; spectral and magnetic characteristics; Coordination numbers, stereo chemistry. lanthanide shift reagents - nuclear and non-Nuclear applications.

UNIT – II

Substitution reactions - lability - inertness - substitution in octahedral complexes – Acid hydrolysis, base hydrolysis - anation reaction - reactions without metal ligand bond cleavage square planar substitution reactions - factors affecting reactivity of square planar complexes - trans effect, theories of trans effect mechanisms of electron transfer reaction - outer, inner spheres, synthesis of coordination compounds using electron transfer and substitution reactions - molecular rearrangement in tetrahedral and octahedral complexes - mechanism of racemization of tris chelates, Fluxional molecules - - stereo chemical non rigidity - isolobal fragments.

UNIT III

Inorganic Photo Chemistry
Excited states of coordination complexes - properties of excited states - photochemical pathways - energy transfer and charge transfer in photo chemistry - photo redox reaction - photo substitution reactions. Photoanation, photo aquation, photo rearrangement. Ruthenium polyprridyls - chromium polypyridyls. Role of TiO_2 in solar energy conversion - photo chemical conversion and storage of solar energy - Inorganic photo chemistry at semiconductor electrodes - bioinorganic aspects of inorganic photochemistry. Photochemistry of organometallic compounds.

UNIT IV

Transition metal organometallics
EAN rule - importance of 16 and 18 electron rule in organometallics – Carbon sigma donors – alkyls and aryls, metal carbene and carbyne complexes. Carbon pi – donors- synthesis, structure and bonding in Olefin, acetylene, allyl and chain polyene complexes, ferrocence and other cyclopentadiene analogues, benzenoid complexes. Synthesis, structure and bonding in

metal carbonyls, nitrosyls, isonitriles and synthesis and structure of mono and polynuclear carbonyls. Reaction of coordinated ligands, Homogeneous catalyst – selectivity in homogeneous catalysis- coordinative unsaturation, oxidative addition, reductive elimination and insertion reactions. Tolman catalytic loop. Catalysis mechanism in the following reactions Hydrogenation of olefins (Wilkinson) including chiral synthesis; Hydroformylation (Oxo process) using Co and Rh catalysis, Monsanto acetic acid synthesis, Wacker process. Heterogeneous catalysis- Ziegler – Natta polymerization role of Reppe's or Wilke's catalyst, olefin isomerisation using Ni catalyst, Synthetic gasoline: Fischer – Tropsch and Mobil processes

Text Books:

1. Inorganic Chemistry - James Huheey IV edn. Harper - Collins
2. Coordination Chemistry - Basolo and Johnson
3. Concepts of Inorganic Photo chemistry - A.W. Adamson
4. Elements of Inorganic Photo chemistry - C.J. Ferradi - John Wiley

Reference

1. Advanced Inorganic Chemistry - R.G. Wilkins and Lewis
2. Modern Inorganic Chemistry- Emeleus & Sharpe- ELBS
3. Complex Equilibria - T. Beck
4. The study of Ionic equilibria - Hazel Rossotti - Longman -London
5. Chemistry of Lanthanides and Actinides - T. Moeller
6. Theoretical basis of Inorganic Chemistry- Barnard- Tata McGrawhill
7. Comprehensive Inorganic chemistry - J.C. Bailar Ed. Vol V Pergoman
8. Inorganic Chemistry A Unified Approach - William W. PorterField Academic Press inc. 1993
9. Mechanism of inorganic reactions in solutions - D. Benson - Mc GrawHill 1968
10. Ligand substituion processes- Langford and Gray Benjamin
11. Organometallic photochemistry - Geoffery, Weighton . - Academic Press.
12. Modern Inorganic Chemistry - William L. Jolly II Edn - McGrawhill 1991
13. Principles of Organometallic Chemsitry - P. Powell - ELBS
14. Inorganic chemistry - Catherine E. Housecroft.

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THE MADURA COLLEGE (AUTONOMOUS) MADURI – 11
(Affiliated by Madurai Kamaraj University)

Class : M.Sc., (CHEMISTRY) Sub.Code : 3PGC3

UPTO 2016

Title : PHYSICAL CHEMISTRY-III Qn.No. : 2170

Time : 3 Hours Max.Marks : 75

Credits : 4

UNIT – I

MOLECULAR SPECTROSCOPY I

Interaction of electromagnetic radiation with matter - Einstein's coefficients - induced emission and absorption - microwave, Infra-red and Raman spectroscopy of diatomic and simple polyatomic molecules - theory, selection rules, experimental methods and applications- Determination of molecular parameters. Basic concepts of Fourier transform IR spectroscopy – principle of Laser actions- Laser Raman spectroscopy Electronic spectra of diatomic and simple ploy-atomic molecules - Born - Oppenheimer approximation. Franck - Condon. principle - Dissociation energy calculation – Pre dissociation spectra - Birge - Sponer exproplation - Fortrat diagram.

UNIT – II

MOLECUALR SPECTROSCOPY II

Photo electron spectroscopy (PES) - basic principles-instrumentation - 'X' ray photoelectron spectroscopy (XPS) and UV photoelectron spectroscopy (UPES) -core energy level studies- applications of ESCA. spin - resonance spectroscopy - NMR spectroscopy (proton) -theory - experimental technique - chemical shift - spin - spin splitting (relaxation process) -important applications - basic principles of FT - NMR spectroscopy – 13C -NMR and applications.

UNIT – III

MOLECULAR SPECTROSCOPY III

ESR spectroscopy - hyperfine structure of esr absorption. [electron - nucleus coupling] - factors affecting the magnitude of 'g' values - double resonance in esr - fine structure in ESR spectra (electron - electron coupling)-NQR spectroscopy - Experimental technique - theory - nuclear quadrupole coupling in molecules - applications - Nature of chemical bond - structural information Mössbauer spectroscopy - principles - experimental method - isomer shift - quadrapole effects- applications

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3PGC3 (2012 on)

UNIT – IV

PHOTOCHEMISTRY AND RADIATION CHEMISTRY

Laws of photochemistry - quantum efficiency photo physical processes in electronically excited molecules - Jablonski diagram Primary and secondary processes - fluorescence - delayed fluorescence (E- type and P- type) – kinetics of fluorescence Stern-Volmer equation and its applications phosphorescence - internal conversion - intersystem - crossing - photosensitization - energy transfer mechanism. Chemiluminescence - flash photolysis - stimulated emission - Lasers and their applications. Photosynthesis (elementary aspects) - Solar energy conversion and storage. Radiation chemistry- of aqueous solutions - radiation dosimetry - hydrated electron and its properties.

Text Books

1. Fundamentals Of Molecular spectroscopy-IV Edition-C.N.Banwell&E.McCash., McGraw-Hill, 1994.
2. Fundamentals of Photochemistry - Rohatgi Mukherjee K.K, Wiley Eastern Ltd., New Delhi, 1978.
3. Radiation Chemistry - G.Hughes

References

1. Basic principles of spectroscopy - Raymond chang
2. Spectroscopy - vol.1,2 and 3 - BF Straughan & S.Walker
3. Modern Molecular photochemistry - N.J.Turro., Benjamin-Cummings, 1978.

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PROGRAMME : M.Sc., Chemistry **COURSE CODE : 4PGC1 (Upto 2016)**

COURSE TITLE : Organic Chemistry - IV **QN.NO : 2174**

TIME : 3 Hours **MAX.MARKS :75**

UNIT I

Organic Synthesis:

Importance of synthesis – carbon-carbon bond making reactions – functional group modifications – reterosynthetic analysis – synthons and synthetic equivalents – nucleophilic, electrophilic, electroneutral and free radical synthons – retron, partial retron and super retron – Chiron – Umpolung – protection and deprotection- activation and blocking groups. Applications of retro synthetic analysis to select natural products – Juvabione, Longifolene.

UNIT-II

a) **Green Chemistry:**
Twelve principles of green chemistry-Green chemical method of synthesis-use of microwaves in organic synthesis-Solventless reactions – green solvents – supercritical fluids for extraction – ionic liquids.
(b) **Polycyclic systems:**
Nomenclature of bicyclic systems; large ring compounds; Study of adamantane, diamantane, twistane, cubane, bullvalene, fullerenes & catenanes.
(c) **Alkaloids**: Structure , Synthesis & stereochemistry of berberine, morphine, lysergic acid, yohimbine and reserpine.

UNIT III

a) Study of pheromones, juvenile hormones and prostaglandins
(b) **Anthocyanins and flavones**: Chemistry of cyanin chloride, quercetin, bio-chanin-A, dalbergin
(c) **Carbohydrate**: Determination of ring size of mono saccharides, their configuration and conformation; structure, synthesis of sucrose, maltose and lactose; a brief study of Starch, cellulose and amino sugars

UNIT IV

Steroid, Bile acids and Sex hormones: Structure and stereochemistry of steroidal nucleus; Structure and synthesis of (a) Cholesterol, lanosterol, ergosterol and stigmasterol ; (b) Cholic acids (c) Estrone and equilenin (d) Progesterone, androsterone and testosterone (e) Corticosteroids

Text Books

1. Organic chemistry .I.L.LINAR (VOL-2)
2. Green Chemistry- Rashmi Sanghji, M.M. Srivastava
3. Organic synthesis-R.F.Ireland
4. Principles of Organic Synthesis -R.O.C.Norman
5. A. Kar, Medicinal Chemistry

References:

1. Advanced Organic Chemistry - J. March
2. Advanced Organic Chemistry - Fieser & Fieser
3. Alicyclic Compounds - D. Lloyd
4. Catenanes, Rotaxanes and Knots - G. Schil
5. Chemistry of Adamantanes - Birgham & Seheleyer
6. Synthesis of Prostaglandins – Ingrahim
7. Advanced Organic Chemistry -Carey and Sundberg
8. Steroids - Fieser and Fieser
9. Biogenesis of Natural Products - Bernfield
10. Chemistry of steroids -R.N. Shoppe
11. Medicinal Chemistry - Burger
12. Alkaloids - Bently - Vol. I & II
13. Total synthesis of Alkaloids - Naganishi Vol I & II
14. Alkaloids - A series of volumes by Manske & Hams

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PROGRAMME : M.Sc., Chemistry **COURSE CODE : 4PGC2 (Upto 2016)**

COURSE TITLE : Inorganic Chemistry - IV **QN.NO : 2176**

TIME : 3 Hours **MAX.MARKS :75**

UNIT - I
SOLID STATE

Crystal Structure: Crystalline and amorphous solids; crystal systems-Elements of symmetry- point groups and space groups- unit cells and space lattices, glide plane, screw axis: methods of characterizing crystal structure - Powder x-ray diffraction electron and neutron diffraction; - analysis of data and determination of lattice types and unit cell dimensions in cubic system- elementary concept of structural factor and scattering factor. types of close packing - hcp and ccp, packing efficiency, radius ratios; polyhedral description of solids; structure types -NaCl, ZnS, Na_2O, $CdCl_2$, wurtzite, nickel arsenide, CsCl, CdI_2, rutile and Cs_2O, perovskite ABO_3, K_2NiF_4, spinels inverse spinels. Crystal defects - Frenkel and Schotky defects, point, line and plane defects, and non-stoichiometric compounds

UNIT- II
Characterization of solids:

Thermal analysis: TGA, DTA, DSC

Electrical properties: Band theory of solids -metals and their properties; semiconductors - extrinsic and intrinsic, Hall effect; thermoelectric effects (Thomson, Peltier and Seebeck); insulators - dielectric, ferroelectric, pyroelectric and piezoelectric properties; ionic conductors – solid state electrolytes.

Magnetic properties: Dia, para, ferro, ferri, and antiferro magnetic types; soft and hard magnetic materials; select magnetic materials such as spinels, garnets and perovskites, hexaferrites and lanthanide-transition metal compounds; magnetoresistance.

Superconductivity: Basics, discovery and high Tc materials.

UNIT -III
Nuclear Chemistry

Nuclear properties - Nuclear spin and moments origin of nuclear forces - Salient features of liquid drop and shell models of the nucleus. Detection and determination of radioactivity by - bubble chamber, proportional counter GM counter, Scintillation counter and Cerenkov counters, solid state ionization counter. Nuclear reactions - types - reaction cross section - Q value - threshold energy of nuclear reaction - high energy nuclear reactions – Spallation, Hot atom chemistry, Neutron activation analysis and its applications, Nuclear fission and fusion - characteristic of mass and charge distribution of fission products. Theory of fission . Principles of thermonuclear reaction, Stellar energy, Fissile and fertile isotopes classification of nuclear reactors. Reprocessing on nuclear materials, Radiation protection and waste disposal. Atomic power project in India.

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UNIT- IV

Nano chemistry

Nanoparticles - Definition - Size-relationships of Chemistry, nano particles and solid - state physics - Nanoparticles of metals, semiconductors and oxides - synthesis - Physical and chemical methods - Gas evaporation - Solvated metal atom dispersion-physical vapour deposition-thermal decomposition-Reduction methods - colloidal and micellar approach- sol-gel method - chemical vapour deposition.

Physical properties of nano materials - Finite-size effects -surface/interface effects-solubility-super Para magnetism - optical and electronic properties - Chemical properties - semiconductor nanoclusters-applications in photocatalysis and other general applications of nanoparticles. Carbon nanotubes – Préparation, salient properties, applications. Conducting polymers nanostructure.

Text Books:

1. Solid state chemistry and its Applications - R.West - John Wiley & Sons, 1984.
2. Elementary Solid state physics - Kittel
3. Solid state chemistry - CNR Rao and Gopalakrishnan
4. Essentials of Nuclear chemistry - H.J.Arnikar
5 Nanostructured materials and nanotechnology - Hari Singh Nalwa, Academic Press, 1998.
6. Nuclear & Radiochemistry - G.Friedlender, J.W.Kennedy & J.M.Millerr, John Wiley

Reference

1. An introduction to Crystallography - F.C.Phillips Fourth Edn ELBS.
2. Symmetry in chemistry - Jeffe & Orchin.
3. Physical chemistry - W.J.Moore.
4. Advanced Inorganic chemistry - F.A.Cotton & G.Wilkinson wiley
5. Structural Principles of Inorganic chemistry - Addison.
6. Inorganic solids - D.M. Adems - John wiley
7. Super conductivity: Basic Inorganic chemistry IIIrd Edn
8. Concise Inorganic chemistry - J.D.Lee ELBS. Fourth Edn.
9. Modern Aspects of Inorganic chemistry - Emeleus and Sharpe.
10. Structure and properties of materials - Robert M. Rose and A. Shepard John Wiley Eastern 1971
11. Nuclear chemistry - Dash
12. Instrumental methods of chemical analysis - G. Chatwal and S.Anand - Himalayan Publishing House - Delhi
13. Chemistry of Advanced Materials - An overview - Leonard V. Interrante and Mark J. Hampden-Smith - (Ed.) Wiley-VCH, 1998.
14. Environmental photochemistry with semiconductor nanoparticles - P.V.Kamat and K.Vinodgopal

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : M.Sc., Chemistry **COURSE CODE : 4PGC3 (Upto 2016)**

COURSE TITLE : Physical Chemistry - IV **QN.NO : 2178**

TIME : 3 Hours **MAX.MARKS :75**

UNIT : I

ELECTROCHEMISTRY – I

Electrolytic conductance and Electrified interface

Ion –ion and ion solvent interactions – theory of strong electrolytes - interionic attraction theory – Debye - Huckel Onsager equation - derivation, experimental verification and modification – Debye Falkenhagen effect and first Wein effect–second Wein effect - disaaociation field effect ionic activity and activity coefficients – ionic strength- derivation of Debye - Huckel limiting law - Huckel - Bronsted equation - determination of activity coefficients using Bronsted equation - electro kinetic phenomena - Theories of double layer- Helhmholtz, Perrin, Gouy-Chapmann and Stern theories

UNIT – II:

ELECTRODE POTENTIAL AND ELECTRODICS

Electrode potential - origin of different types of potentials - EMF of cells - electrochemical cells - reversible cells - thermodynamics of reversible cells-determination of equilibrium constant, dissociation constant, solubility product .Electrode kinetics - energy barrier at electrode surface - electrolyte interface over voltage – theories of over voltage - Butler - volmer equation - Tafels equation corrosion and passivity- industrial electrochemistry cells and batteries - Hg/Zn, Ni/Cd, lithium cells– storage and fuel cells - solar cells and batteries.

UNIT – III

STATISTICAL THEMODYNAMICS

Mathematical principles - macrostates and microstates - thermodynamic probability - Maxwell - Boltzmann distribution law -Quantum statistics - Bose -Einstein and Fermi - Dirac distribution laws - partition functions - Thermodynamic properties, Internal energy , enthalpy , entropy , free energies , heat capacity, equilibrium, constant from partition functions, Statistical approach to the third law- attainment of absolute zero-concept of negative absolute temperatures-applications of quantum statistics. Black body radiation - Bose -Einstein. condensation - Liquid He^4 - Electrons in metals - Heat capacity of solids - Einstein and Debye theories of heat capacity of solids- Debyes T^3 law.

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UNIT IV :

SURFACE CHMISTRY AND CATALYSIS

Physical and chemical adsorption of gases on solid surface - Langmuir and BET adsorption isotherms - Determination of surface area of solid catalyst - Heat of adsorption - adsorption on liquid surface - surface films - Gibbs adsorption isotherm – Temkin adsorption isotherm. Homogeneous catalysis - acid-base catalysis - mechanism - Bronsted relationships – primary, secondary' salt effect acidity functions - Hammett's acidity function - Linear -free energy relationships - enzyme catalysis Michaeli's - Menten kinetics.

Text Books:

1. An introduction to electro chemistry - S. GLASSTONE.
2. Principles and applications of electro chemistry – CROW. D.R ,Chapman and Hall, 1988.
3. Thermodynamics - J.Rajaram & J.C. Kuriacose, S. Jagin and Co, Jalandhar (India) 1986
4. Statistical Thermodynamics - M.C.Gupta, Wiley Eastern Ltd.,New Delhi, 1974.
5. Physical Chemistry of Surface - A.W.Adamson and A. Gast, 5th edn., Wiley 1997.

References

1. Modern Electro Chemistry - Vol I & II - J.O.M. BOCKRIS & A.K.N.REDDY, 2nd edn., Plenum 1998.
2. Theoretical electro chemistry - L. ANTRAPOV.
3. Industrial electro chemistry, - FLETCHER.
4. Theoretical chemistry - S. Glasstone
5. Heat and thermodynamics - Zemansky.M. W,5th edn., McGraw-Hill, 1968
6. Physical Chemistry Atkins P.W. and J. de Paula, 8th edn., Oxford University Press, 2006.
7. Introduction to colloid and surface chemistry D.J.Shaw
8. Physical Chemistry of Surfaces, Adamson, A.W, Gast .A, 5th edn., Wiley 1997.

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : M.Sc., Chemistry **COURSE CODE : 4PGC4 (Upto 2016)**

COURSE TITLE : Biochemistry **QN.NO : 2180**

TIME : 3 Hours **MAX.MARKS :75**

UNIT-I

BioInorganic chemistry

Transport proteins, oxygen carriers in various bio systems. Porphyrin system-metalloporphyrins. - hemoglobin- myoglobin – structure and work functions. Bohr effect, cooperativity - Perurtz machanism, synthetic oxygen carriers. Cytochromes and their classification, Structure and work functions in respiration etc. Copper containing proteins and their classification – Blue copper proteins, role of cytochrome C oxidase and Cyt P –450. Non-heme iron proteins-rubredoxin and various ferridoxins. Chlorophyll –structure-photosynthetic sequence – salient features of photosynthetic process. Corrin system, vitamin B_{12} and B_{12} coenzymes and their structures. Role of B_{12} coenzymes. *In-vivo and in-vitro* nitrogen fixation – structure and function of nitrogenase. Zinc enzymes- carbonic anhyhdrase, carboxy peptidase and superoxide dismutase, structure and mechanism of their action, enzyme action – inhibition and poisoning. Essential and trace elements in biological system-metal ion toxicity and detoxification. Metals complexes in medicine with particular reference to anticancer drugs. Metal storage transport and biomineralisation Ferritin, Transferritin and siderophere only – Na, K balance; Ion pump. Metal complexes - nucleic acid interactions, their type and the principle of the method used in recognition of such interactions.

UNIT-II

Metabolic Reactions

Fatty acid metabolism: Biological importance of fatty acids and lipids, even chain and odd chain fatty acids, saturated and unsaturated fats, ketone bodies, fatty acid metabolism, calorific value of foods, bological membranes, properties and function of lipid bilayers and liposomes.

Protein-related transformations: Amino acid degradation (C3, C4, C5 family), urea cycle, uric acid and ammonia formation; Enzymatic hydrolysis of proteins to peptides; Amino acid sequencing; amino acid metabolism (biosynthesis and degradation).

UNIT-III

Nucleic Acids

Chemical and enzymatic hydrolysis of nucleic acids; Structure and function of mRNA, tRNA, rRNA; Polymorphic nature of DNA, B- and Z-DNA, multi-stranded DNA; DNA sequence determination by chemical and enzymatic methods, Genetic code – origin, salient features, wobble hypothesis; Gene expression – transcription and translation; Gene mutation and carcinogenesis

UNIT-IV

Enzymes and Co-Enzymes

(a) Co-enzyme chemistry: Cofactors derived from vitamins, coenzymes, prosthetic groups, apoenzymes; Structure & biological function of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD+, NADP+, FMN, FAD, lipoic acid and vitamin B12; Mechanisms of reactions catalyzed by above co-factors.

(b) Enzyme models: Host-guest chemistry, chiral recognition and catalysis, molecular recognition, diometric chemistry, crown ether, cryptates; Cyclodextrins, cyclodextrin-based enzyme models, calixarenes, ionophores, micelles, synthetic enzymes.

Textbooks

1. Stryer, L. *Biochemistry* (4th edn.), W. H. Freeman & Co. (1995).
2. Zubay, S.. *Biochemistry*, Addison-Wesley (1983).
3. Sindell, R. P. *DNA Structure and Function*, Academic Press (1994).
4. Saenger, W. *Principles of Nucleic Acid Structure*, Springer-Verlag (1984).
5. G.N.Mukherjee & Arabinda Das-Elements of Bioinorganic Chemistry, 1993.
6. Dr.Asim K.Das, Bioinorganic Chemistry
7. C.B.Powar & G.R. Chatwal, Biochemistry

Reference Books

1. F.A. Cotton, G. Wilkinson & P. Gaus Basic Inorganic chemistry III Edn John wiley (1995)
2. James Huheey - Inorganic Chemistry IVth Edn. Collin – Harper (1993)
3. Shriver, Atkins and Langford - Inorganic chemistry IInd Edn oxford University Press (1984)
4. Keith Purcell and J.C. Kotz Inorganic Chemsitry W.B. Saunders
5. F.A. Cotton and G. Wilkinson Advanced Inorganic Chemistry John Wiley
6. State of the art Symposium on Bioinorganic Chemistry J Chem Ed 1985 Vol 62 Issue 11
7. Dugas, H. & Penny, C. *Bioorganic Chemistry: A Chemical Approach to Enzyme Action*, Springer Verlag (1998).
8. Palmer, T. *Understanding Enzymes*, Prentice Hall (1995).
9. M.1. Page and A. Williams (eds.). *Enzyme Mechanisms*, Royal Society of Chemistry, (1987).
10. Price, N. C. & Stevens, L. *Fundamentals of Enzymology*, Oxford University Press (1989)
11. Trevan, M. D. *Immobilized Enzymes: An Introduction and Applications Biotechnology*, John Wiley (1980).
12. Fersht, A. & Freeman, W. H. *Enzyme Structure and Mechanism*, W.H. Freeman, NewYork (1985).
13. Metzler, D. E. *Biochemistry: The Chemical Reactions of Living Cells*, Academic Press(2001)
14. Lippard & Berg, Principles of Bioinorganic Chemistry
15. Thomas M.Devin, Text Book of Biochemistry with clinical correlations, 2nd edition, John Wiley & Sons
16. Lippard, Grey & Bartini, Bioinorganic Chemistry
17. Lehlninger, Nelson and Cox, 1993, Principles of Biochemistry

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME :M.Sc., Chemistry **COURSE CODE : 17P1CMC1**

COURSE TITLE : Organic Chemistry-I **QN.NO : 8701**

TIME : 3 Hours **MAX.MARKS :75**

UNIT I NATURE OF BONDING IN ORGANIC MOLECULES

Delocalized chemical bonding – conjugation - crosss conjugation – resonance – hyperconjucation -bonding in fullerenes – tautomerism.

Aromaticity: Huckel rule- aromaticity, anti-aromaticity, homo aromaticity, in benzenoid and non-benzenoid compounds, alternant-non-alternant hydrocarbons, energy level of π-molecular orbitals, annulenes.

Bond weaker than covalent - addition compound, crown ethers, complexes and cryptands, inclusion compounds, cyclodextrins, catenanes and rotaxanes.

UNIT II REACTION MECHANISM, STRUCTURE AND REACTIIVITY

Electronic effects-Inductive, field, Resonance-Steric Inhibition of Resonance.

Types of mechanisms- potential energy diagrams, transiton states and intermediates- kinetic and thermodynamic control, Hammond's postulate, Curtin-Hammett principle, methods of determining mechanisms, isotope effects, hard and soft acids and bases.

The Hammett equation and linear fee energy relationship, substituent and reaction constants. Taft equation.

Reactive Intermediates: Carbocation, carbanion, carbene and nitrene: generation, structure and reactivity-

UNIT III ALIPHATIC NUCLEOPHILIC SUBSTITUTION

The S_N1, S_N2, mixed S_N2 and S_Ni mechanisms.

The neighbouring group participation by π and σ bonds, anchimeric assistance. Classical and non classical carbocations, phenonium ions, norbornyl system, common carbocation, rearrangements, applications of NMR spectroscopy in the detection of carbocations

The S_N1 mechanism. Nucleophilic substitution at allylic, aliphatic trigonal, vinylic carbon.

Effects of substraste strucutre, attacking nucleophile, leaving group, and solvent polarity on the reactivity.

UNIT IV AROMATIC ELECTROPHILIC AND NUCLEOPHILIC SUBSTITUTION

The arenium ion intermediate, energy profile diagrams, orientation and reactivity in mono and disubstituted benzene ring - ortho/para ratio, ipso attack, orientation in other ring systems: naphthalene, anthracene, phenanthrene, pyrrole, indole, pyridine, quinoline and isoquinoline. Quantitative treatment of reactivity in substrate and electrophiles. Diazonium coupling, Vilsmeir reaction, Gattermann –Koch reaction.

Aromatic Nucleophilic substitution: The S_NAr, S_N1 and benzyne mechanisms. Reactivity-effect of substrate strucutre, leaving group and nucleophile. The Von Richter, Sommelet Hauser and Smiles rearrangements.

P.T.O.

UNIT V FREE RADICAL AND ELIMINATIONS REACTIONS

Types of free radical reactions, free radical substitution mechanism, mechanism at 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 , 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.

Elimination Reactions

The E_2, E_1 and E_1CB mechanism - Orientation of the double bond. Reactivity – effects of substrate strucutres, attacking base, the leaving group and the medium. The mechanism and orientation of pyrolytic elimintion.

Text Book(s):

1. Clayden, J., Greeves, N., Warren, S. and Wothers, P., "Organic Chemistry", First Edition, Oxford University Press, New York, 2006.
2. March, J., "Advanced Organic Chemistry", Sixth Edition, John Wiley & Sons, New York, 2007.
3. Smith, M. B., "Organic Synthesis", Second Edition, McGraw-Hill International Edition, New Delhi, 1994.
4. Skyes, P., "A Guide Book to Mechanism in Organic Chemistry", Sixth Edition, Pearson Education Ltd., New Delhi, 2011.
5. Finar, I.L., "Organic Chemistry", Vol. II, Sixth Edition, Pearson Education Pvt. Ltd., Singapore, 2006.
6. Mukherji, S.M., and Singh, S. P., Organic Reaction Mechanism by MacMillan India Ltd.

Reference Books:

1. Ahluvalia, V.K., "Chemistry of Natural Products", First Edition, Vishal Publishing Co, Jalandhar, 2008.
2. Carrutherus, W., "Some Modern Methods in Organic Synthesis", Third Edition, Cambridge University Press, New York, 1997.
3. Ireland, R.E., "Foundation of Modern Organic Chemistry Series- Organic Synthesis", First Edition, Prentice – Hall of India Pvt. Ltd., New Delhi, 1975.
4. Mackie, R.K., Smith, M.M., and Aitken, R.A., "Guide Book to Organic Synthesis" Second Edition, Longman Scientific and Technical, Singapore, 1990.
5. Bruckner, R., "Advanced Organic Chemistry – Reaction Mechanism", First Edition, Elsevier India Pvt. Ltd., New Delhi, 2005.
6. Norman, R. and Coxon, J. M. Principles of Organic Synthesis, Blackie Academic &Professional, 1988.

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THE MADURA COLLEGE (Autonomous), MADURAI – 625 011
(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)
RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME :M.Sc., Chemistry **COURSE CODE : 17P1CMC2**

COURSE TITLE : Inorganic Chemistry-I **QN.NO : 8702**

TIME : 3 Hours **MAX.MARKS :75**

UNIT I IONIC BOND

Lattice energy and its determination by Born-Haber cycle and other application of BHC, Born-Lande & Born–Meyer equations, significance of Madelung constant - hardness, electrical conductivity and solubility of ionic compounds - Different types of electrostatic interaction, hydrogen bond. Partial ionic character – resultant of polarization. Fajan's rule – dipole moment determination and its applications.

UNIT II COVALENT BOND –I

Covalent bond: Qualitative treatment of valence bond & molecular orbital theories-LCAO approximation – symmetry of M.O.'s - Sigma and Pi bonds. Calculation of s and p character – Bent's rule. Bond properties - bond order, bond energy, bond length and bond polarity. Application of MOT to homonuclear (H_2, He_2, Li_2, Be_2, B_2, C_2, N_2, O_2, F_2 and their ions) and heteronuclear diatomic molecule (CH_4, NH_3, H_2O,NO and CO) and triatomic molecules like BeH_2 and CO_2. Walsh diagrams for AB_2 molecule. Comparison of VB & MO theories.

UNIT III COVALENT BOND-II

Hybridization – various types of hybridization with examples. Delocalization – resonance-VSEPR theory of molecules containing only bond pairs of electrons (BeF_2, BH_3, CH_4, PF_5, SF_6, IF_7 molecules. Geometry of molecules containing both bond pair and lone pairs of electrons ($SnCl_2$, NH_3, H_2O, SF_4, ClF_3, IF_5). Application of VSEPR theory to xenon compounds.

UNIT IV INORGANIC CHAIN, RING AND CLUSTER COMPOUNDS

Polyacids-isopolyacids and heteropoly acids of vanadium, chrominum, molybodenum and tungsten. Silicates: occurrence and structure of silicates: orthosilicates, pyrosilicates, cyclic silicates, chain silicates, sheet silicates and 3 dimensional silicates. Silicones and applications.

Metal Clusters: Bonding and structures of following clusters:Dinuclear Clusters: Cu(II)carboxylate, Chromium(II)acetate, and $[M_2Cl_8]^{4-}$where M = Mo, and Re

P.T.O.

Trinuclear Clusters: $[M_3(CO)_{12}]$ where M = Fe, Ru, Os Tetranuclear Clusters: $[M_4(CO)_{12}]$ where M = Co, Rh, Ir Hexanuclear Clusters: $[Nb_6Cl_{12}]^{2+}$ and $[Mo_6Cl_8]Cl_4$. Poly atomic Zintl ions

UNIT V CAGE COMPOUNDS AND INORGANIC POLYMERS

The concepts of multicentre bond as applied to electron deficient molecules-boron hydrides-metal alkyls. Preparation, properties and structure of boron hybrides-diborane - carboranes- Metallocarboranes- higher borane, Wade's rules and styx number- boron-nitrogen compounds, borazine, boron nitride. P-N compounds-phosphazenes, polyphosphazenes-polythiazyl, S-N compounds-S_4N_4.

Text Book(s):

1. Gilreeth, E.S., Fundamental concepts of Inorganic Chemistry, Mcgraw Hill, India, 2015.
2. Jolly, W. L., Modern Inorganic Chemistry, Second Edition, Mcgraw Hill, New York,1991.
3. Lee. J.D., Concise Inorganic chemistry, Fifth Edition, Wiley India Pvt, New Delhi,2008.
4. Cotton, F.A., and Wilkinson, Advanced Inorganic Chemistry, John Wiley & Sons Ltd., London-New York, 1972.
5. James Huheey, Inorganic Chemistry, Fourth edition, Harper – Collins, New York, 1993.

Reference Books:

1. Coulson, C. A.,Valence ,Second Edition, Oxford, Clarendon, 1961.
2. Purcell, K.F., Kotz J.C., Saunders W.B., Inorganic chemistry, Saunders College Publishing, Philadelphia, 1980.
3. Emeleus, H.J., and Sharpe, A., Modern Aspects of Inorganic chemistry, Fourth Edition, Routledge and Kegan Paul, United Kingdom, 1975.
4. Day, C., Selbin, J, Theoretical Inorganic Chemistry, Second Edition, Von. Nostrand, 1980.

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME :M.Sc., Chemistry **COURSE CODE : 17P1CMC3**

COURSE TITLE : Physical Chemistry - I **QN.NO : 8703**

TIME : 3 Hours **MAX.MARKS :75**

UNIT I PROPERTIES OF GASES AND LIQUIDS

Equations of states-Molecular speeds-Max Well distribution of molecular velocities- one, two and three dimensions-Energy distribution-Maxwell-Boltzmann distribution law-Principle of equipartition of energy and heat capacity-Rotation, vibration and Translational degree of freedom-Molecular collisions-Mean free path-Transport properties-Thermal conductivity-Viscosity and diffusion of gases.

Liquid State-Theory of liquids-Internal Pressure-Liquid crystals-Nematic, Cholesteric, Smectic-Theory and application in liquid crystal display.

UNIT II THERMODYNAMICS

Thermodynamic equations of state - derivation and application to real gases in the calculations of $(dH/dp)T$,$(dE/dv)T$ and $\mu_{J.T}$ etc. Thermodynamics systems of variable composition. Partial molar properties : Chemical potential: Definition - Gibbs-Duhem equation. Determination by graphical method. Variation of chemical potential with temperature and pressure. Fugacity: Definition - Determination of fugacity. Variation of fugacity with temperature and pressure. Activity: Definition –Determination of activity and activity coefficient of non-electrolytes by vapour pressure measurements. Dependance of activity on temperature and pressure. Third law of thermodynamics: absolute entropies – determination of absolute entropies – exceptions to third law.

UNIT III QUANTUM CHEMISTRY- I

Black Body radiation –de Broglies wave particle duality- Experimental verification of matter waves-Compton effect-Heisenberg's Unvertinity principle-The schrodinger wave equation, Postulates of Quantum mechanics, Operators – Linear operator, commuting operators, Hermitian operator. Eigen functions and Eigen values, Orthogonality and Normalisation. Discussion of solutions of Schrödinger equation to particle in a One Dimensional Box, Three Dimensional Box, The Simple Harmonic Oscillator, The Rigid rotator, The H- atom, Probability Distribution curves, Angular momentum Eigen functions and Eigen Values of angular momentum.

UNIT IV QUANTUM CHEMISTRY- II

Approximation methods – The Variation theorem, Linear variation principle, Application of variation method to He – atom, Perturbation theory (only Time independent, First order and non-degenerate), Application of Perturbation Theory to He-atom. Hartree Fock Self consistent Field Theory, Symmetric and Antisymmetric Wave functions, Pauli's exclusion principle of Antisymmetric wave functions, Huckel Molecular orbital theory – Huckel theory of conjugated system-Delocalization Energy, Bond order and Charge density Application of HMO to ethylene, butadiene and cyclopropenyl system.

P.T.O.

UNIT V CHEMICAL EQUILIBRIUM AND PHASE RULE

Chemical equilibrium: Thermodynamic derivation of equilibrium constant (Kp) for equilibrium involving ideal gases and real gases – van't Hoff reaction isotherm. Heterogeneous equilibrium: Definition – examples - Le Chatelier and Braun Principle - thermodynamic proof - temperature, pressure and concentration dependence. Van't Hoff equation: Derivation and applications. Simultaneous equilibria: Free energy and equilibrium constant.

Basic terminologies of phase rule: - Three component system: three liquid system, one liquid and two solid systems and two liquid and one solid system – three solids system.

Text Book(s):

1. Glasstone, S., "Thermodynamics for Chemists", First Edition, van Nostrand & Co., New York, 2005.
2. Rajaram, R. and Kuriacose, J.C., "Thermodynamics", Second Edition, S. Chand and Co., New Delhi, 1993.
3. Kapoor, K.L., "A Text Book of Physical Chemistry", Volumes 2 & 5, Fourth Edition, Macmillan India Ltd., New Delhi, 2011.
4. Mc Quarrie, D.A. and Simon, J.D., "Physical Chemistry- A Molecular Approach", First South Asian Edition, Viva Books Pvt. Ltd., New Delhi, 2011.
5. Chandra, A.K., "Introductory Quantum Chemistry", Fourth Edition, Tata-McGraw Hill Publication Co. Ltd., New Delhi, 2010.
6. Atkins, P. and de Paula, J., "Physical Chemistry", Ninth Edition, Oxford University Press, New Delhi, 2011.
7. Ball, D. W., "Physical Chemistry", First Indian Edition, Cengage Rearing India Pvt., Ltd., New Delhi, 2009.

Reference Books:

1. Mortimer, R.G., "Physical Chemistry", Third Edition, Academic Press – An imprint of Elsevier, London, 2009.
2. Engel T. and Reid, P. "Physical Chemistry", Second South Asian Edition, Pearson Publication, New Delhi, 2011.
3. Berry, R.S., Rice, S.A and Ross. J, "Physical Chemistry", Second Edition, Oxford University Press, New York, 2007.
4. Puri, B.R., Sharma, L.R. and Pathania, M.S., "Principles of Physical Chemistry", Forty Sixth Edition, Vishal Publishing Co., Jalandhar, 2013.
5. Bhal, A., Bhal, B.S. and Tuli, G.D., "Essentials of Physical Chemistry", First Edition, S. Chand & Company Ltd., New Delhi, 2012.

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME :M.Sc., Chemistry **COURSE CODE : 17P1CME1**

COURSE TITLE : Analytical Chemistry-I **QN.NO : 8704**

TIME : 3 Hours **MAX.MARKS :75**

UNIT I OXIDATION AND REDUCTION AND MAGNETO CHEMISTRY

Concept of oxidation and reduction potentials – periodic trends – applications of electrode potentials in the interpretation of chemical behavior. Electrode potential diagrams and their uses: Latimer diagram – Frost diagram – Pourbaix diagram – Ellingham diagram.

Magnetochemistry - magnitude of magnetic moments - experimental determination – Faraday, Guoy & NMR methods - The concept of the quenching of orbital momentum - Magnetic properties of A,E & T terms - effect of spin - orbit coupling – Temperature Independant Paramagnestism (TIP) Antiferromagnetic interactions in di and poly nuclear transition - metal complexes & solids.

UNIT II ELECTROANALYTICAL TECHNIQUE

Polarography-principle-diffusion current-polarographic maxima-Ilkovic equation- Half wave potential-applications. Pulse voltammetry-normal and square wave voltametry. Cyclic voltammetry- principle and simple analytical applications-interpretation of cyclic voltammogram Amperometry - principles and applications – types of amperometric titrations with examples.

Basic principles of electrogravimetry-procedure-Coulometry-principle-coulometry at controlled potential-coulometry at constant current-coulometric titrations-advantages and its applications.

UNIT III THERMAL ANALYSIS

Theory and principles of DTA and TGA – factors affecting the position of DT and TG curves – application of DTA and TGA .Thermal behavior of the following compounds using DTA and TGA analysis – crystalline copper sulphate penta hydrate, calcium oxalate monohydrate, calcium acetate monohydrate, ammonium nitrate, potassium chlorate with and without catalyst, ammonium metavanadate, zinc hexaflurosilicate – complementary nature of DTA and TGA – principle and applications of DSC - determination of degree of conversion of high alumina cement – purity determination – phase transition study.

UNIT IV CHROMATOGRAPHY AND AAS

Gas-liquid chromatography-principles and its types - retention volume, instrumentation-carrier gas-column - preparation-stationary phase-detectors- Thermal conductivity detector (TCD)- flame ionization detector (FID)-electron capture detector (ECD) - applications of GLC. High performance liquid chromatography (HPLC)-Scope-column efficiency-instrumentation-column packing detectors.

Instrumentation- principle of atomic absorption spectroscopy (AAS)- Interferences – spectral, chemical and Ionisation - applications of AAS.(Qualitative analysis-Quantitative analysis)-multicomponent analysis - determination of metallic elements in biological materials - determination of metallic elements in industrial food products-determination of Ca, Mg, Na and K in blood serum.

P.T.O.

UNIT V ERROR ANALYSIS, ORD AND CD

Error Analysis- Accuracy and Precision, Determinate and Indeterminate errors, Significant figures, Ways of expresssing accuracy – Absolute and relative error, Standard deviation, Propagation of errors, The confidence limit, Tests of significance – The F and T test, Rejection of a result – The Q test, Linear least squares to plot the data, Correlation coefficient.

Optical rotary dispersion (ORD) and Circular Dichroism (CD): Rotational strength of the Chromophores - Cotton effect - Selection rules - its application to D_3 Complexes - the use of ORD & CD in determination of the structure and configuration of the metal complexes.

Text Book(s):

1. Donald, J.,Pietrzyk and Clyde W. Frank, Analytical Chemistry, Second Edition, Academic Press, 1979.
2. Habart, H., Willard, Lynne, L.,Merrit, John A.Dean and Frank, Settle, A., Instrumental Methods of Analysis, Seventh Edition, CBS Publishers, New Delhi, 1986
3. Douglas A. Skoog Donald M. West and F. James Holler, Analytical Chemsitry, Sixth Edition, Saunders College Publishing, HBJ, New York, 1996.
4. Das, R.C., and Beher, B., Experimental Chemistry, Tata Mc. Graw – Hill Ltd., New Delhi, 1983.
5. Gurdeep, G., Chatwal, R., Anand, S. K., "Instrumental methods of chemical analysis", Second Edition, Himalaya Publishing House, New Delhi, 2011.

Reference Books:

1. Findley, A., Practical Physical Chemistry, Nienth Edition, Longmans Green Co. Ltd., London, 1973
2. Khopkar, S.M., Basic Concepts of Analytical Chemistry, New Age International (P) Limited Publishers, New Delhi, 1998.
3. Popiel, W.J., Laboratory Manual of Physical Chemistry, The English Universities Press, London, 1964.

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME :M.Sc., Chemistry **COURSE CODE : 17P2CMC4**

COURSE TITLE : Organic Chemistry-II **QN.NO : 8705**

TIME : 3 Hours **MAX.MARKS :75**

UNIT I ADDITION TO CARBON-CARBON MULTIPLE BONDS

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

Additio to Carbon-Heteroatom Multiple Bonds: Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acids esters, nitriles, Addition of grignard reagents. Organozinc and $LiAlH_4$. Addition reactions of carbonyl compounds-Wittig reaction. Mechanism of condensation reaction involving enolates - Aldol, Knoevenagel, Claisen, Mannich, Benzoin, Perkin and Stobbe reactions.

UNIT II STEREOCHEMISTRY

Elements of symmetry, chirality, molecules with more than one chiral center, *threo* and *erythro* isomers, methods of resolution, optical purity, homotopic, enantiotopic and diastereotopic atoms, groups and faces, stereospecific and stereoselectve synthesis. Asymmmeteric synthesis-Cram's and Prelog rule. Optical activity in the absence of chiral carbon (biphenyls, allenes and spiranes), chirality due to helical shape.

Stereochemistry of the compounds containing nitrogen and sulphur.

Conformational anlysis of cyclohexane, mono- and di- subsituted cyclohexanes, decalins, effect of conformation on reactivity.

UNIT III OXIDATION AND REDUCTION IN ORGANIC CHEMISTRY

Oxidation: Introduction, Different oxidative processes-Hydrocarbons- alkenes, aromatic rings, saturated C-H groups (activated and unactivated), Alcohols, hydrazines and sulphides.

Oxidations using ruthenium tetraoxide, iodobenzene diacetate and thallium (III) nitrate.

Reduction: Introduction. Different reductive processes-Hydrocarbons: alkanes, alkenes, alkynes and aromatic rings - Carbonyl compunds: aldehydes, ketones, acids and their derivatives. Epoxides, Nitro, Nitroso, azo and oxime groups.

UNIT IV REARRANGEMENTS

General mechanism – nature of migration, migratory aptitude, memory effects.

Carbon-carbon migration: Wagner Meerwein, pinacol-pinacolone. Benzil-Benzilic acid, and dienone –phenol rearrangement.

Carbon-nitrogen migration: Beckmann, Hofmann, schmidt, lossen and curtius reaarngements.

Carbon-oxygen migration: Baeyer-Villliger and Dakin rearrangements.

Rearrangements proceeeding through carbanion: Steven, Neber, Sommmelet-Hauser and Favorski rearrangement.

P.T.O.

UNIT V RETROSYNTHESIS

Disconnection approach: Introduction to synthons and synthetic equivalents, disconnection approach, functional group interconversion, the importance of order of events in organic synthesis, one C-X, and two-group C-X disconnections, chemoselectivity, reversal of polarity,

Protecting groups - protection of alcohol, amine, carbonyl and carboxyl groups

One group C-C disconnections - alcohols and carbonyl compounds

Two group disconnections - Diels Alder reaction, Michael additions and Robinson annulations reactions.

Ring synthesis – Longifolene and Juvabione.

Text Book(s):

1. March, J., "Advanced Organic Chemistry", Sixth Edition, John Wiley & Sons, New York, 2007.
2. Skyes, P., "A Guide Book to Mechanism in Organic Chemistry", Sixth Edition, Pearson Education Ltd., New Delhi, 2011.
3. Finar, I.L., "Organic Chemistry", Vol. II, Sixth Edition, Pearson Education Pvt. Ltd., Singapore, 2006.
4. Clayden, J., Greeves, N., Warren, S. and Wothers, P., "Organic Chemistry", First Edition, Oxford University Press, New York, 2006.
5. Smith, M. B., "Organic Synthesis", Second Edition, McGraw-Hill International Edition, New Delhi, 1994.
6. Eliel, E.L., "Stereochemistry of Carbon Compounds", First Edition, McGraw Hill, New Delhi, 2007.
7. Warren, S.Designing Organic Synthesis (A programmed introduction to the synthon approach), John Wiley & Sons.
8. Norman, R. O. C., Coxon, J. M. Principles of Organic Synthesis, and Blackie Academic & Professional, 1988.

Reference Books:

1. Ireland, R.E., "Foundation of Modern Organic Chemistry Series- Organic Synthesis", First Edition, Prentice – Hall of India Pvt. Ltd., New Delhi, 1975.
2. Mackie, R.K., Smith, M.M., and Aitken, R.A., "Guide Book to Organic Synthesis" Second Edition, Longman Scientific and Technical, Singapore, 1990.
3. Bruckner, R., "Advanced Organic Chemistry – Reaction Mechanism", First Edition, Elsevier India Pvt. Ltd., New Delhi, 2005.
4. House, H.O., "Modern Synthetic Reaction", Second Edition, W.A. Benjamin, Inc., London, 1972.
5. Nasipuri, M., "Stereochemistry of Organic Compounds", Third Edition, New Age International, New Delhi, 2007.
6. Ahluvalia, V.K., "Chemistry of Natural Products", First Edition, Vishal Publishing Co, Jalandhar, 2008.
7. Carrutherus, W., "Some Modern Methods in Organic Synthesis", Third Edition, Cambridge University Press, New York, 1997.
8. Warren, S. Work book for organic synthesis, The Disconnection Approach John Wiley & Sons (Asia) Pvt. Ltd.

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME :M.Sc., Chemistry **COURSE CODE : 17P2CMC5**

COURSE TITLE : Inorganic Chemistry-II **QN.NO : 8706**

TIME : 3 Hours **MAX.MARKS :75**

UNIT I SOLID STATE – I

Crystallographic axis - Axial ratios-law of rational indices-Crystal systems-Elements of symmetry-Point groups and space groups-Unit cells-and space lattices-Lattice planes. Schoenflies notation- Herman-Maurgn notation- Glide planes, screw axis-molecular symmetry- Crystal symmetry- Fundamentals of X-ray diffraction-Reciprocal lattice concept, Bragg method. Debye Scherrer method- Wiesenberg's rotating crystal method-Analysis of data and determination of lattice types and unit cell dimensions in cubic system-Elementary treatment of structure factor and scattering factor. Comparison of X ray, neutron and electron diffractions.

UNIT II SOLID STATE – II

Types of close packing- packing efficiency- co-ordination number-relative density of packing in simple cubic, CCP, HCP and BCP. Terahedral and octahedral holes. radius radio rule- Unit cell structure of sodium chloride, zinc blende, wurtzite, fluorite, antifluorite, rutile and cesium chloride – structure of graphite and diamond – spinels normal and inverse types and pervoskite structure. Crystal defects – point, line and plane defects – colour centres – Formation of nonstoichiometric oxides.

UNIT III ELECTRICAL PROPERTIES OF SOLIDS

Electronic structure of solids – Free electron and band theory – Band structure of metals, different types of semiconductors, insulators. P-N junction and photovoltaic effect. superconductivity – types of superconductors. High temperature superconductors. Cooper pair – Meissner effect - Hall effect-thermoelectric effects (Thomson, Peltier, and Seebeck)

UNIT IV NUCLEAR CHEMSITRY

Quantum numbers - liquid drop and shell models of the nucleus (Magic number and nuclear isomerism). Different types of nuclear reaction – spallation, Nuclear fission and fusion and their mechanism - characteristic of mass and charge distribution of fission products. Theory of fission. Fissile and fertile isotopes. Detectors - bubble chamber, GM counter and Scintillation counter nuclear reaction cross section - Q value - threshold energy of nuclear reaction. Application of radio isotopes in various field. Carbon dating – isotope dilution analysis. Neutron activation analysis and its applications, Nuclear reactor and its components. Breeder reactor and Fast Breeder reactor-nuclear waste disposal.

P.T.O.

UNIT V ACID-BASE THEORYAND NON-AQUEOUS SOLVENTS

Acid-base theory Lux-Flood-Lewis-Usanovich concepts. Pearson HSAB concept-Bonding and its applications– symbiosis. Super acids (elementary idea only).

Classification of solvents, properties of ionizing solvents- levelling effect, Typical reactions in non-aqueous solvents *viz* liq. NH_3, liq. SO_2, liq. HF, and H_2SO_4. Molten solvents.

Text Book(s):

1. Phillips, F.C., An introduction to Crystallography, Fourth Edition, ELBS Edition, 1977.
2. JeffeandOrchin, Symmetry in chemistry, John Wiley and Sons, Inc., New York-London-Sydney, 1965.
3. West,A.R., Solid state chemistry,Second Edition, John Wiley, New York, 2014.
4. Moore, W.J., Physical chemistry, Fourth.edition, Longmans Green & Co. Ltd., 1963.
5. Kittel,Elemantary Solid state physics, Eight Edition, Wiley, New York, 2012.
6. Cotton, F.A., and Wilkinson, Advanced Inorganic Chemistry,John Wiley & Sons Ltd.,London-New York, 1972
7. Addison, W. E., and John C. Bailar Jr, Structural Principles of Inorganic chemistry, Hückel, Walter, 1966.
8. Adems, D.M., Inorganic solids,Wiley & Sons, London, New York, Sydney, Toronto, 1974.
9. Phillips, F.C., An introduction to crystallography, Fourth Edition, ELBS.,Longmans, Green and Co., London, 1972.
10. Lee. J.D., Concise Inorganic chemistry, Fifth Edition, Wiley India Pvt, New Delhi,2008.

Reference Books:

1. Emeleus, H.J., and Sharpe, A., Modern Aspects of Inorganic chemistry, Fourth Edition, Routledge and Kegan Paul, United Kingdom, 1975,
2. Robert M. Rose and Shepard,A., Structure and properties of materials, John wiley Eastern, 1971.
3. Rao,CNR., and Gopalakrishnan, Solid state chemistry, Second Edition, Cambridge University Press, UK, 1984.
4. Arnikar, H.J., Essentials of Nuclear chemistry, Second Edition, Wiley, New York, 1987.
5. Dash,U. N.,Nuclear chemistry, Second Edition, Sultan Chand And Sons, 2010.
6. Friedlender, G., Kennedy,J.W., and Millerr, J.M.,Nuclear and Radiochemistry,John wiley, 1982
7. Chatwal, G.andAnand.S., Instrumental methods of chemical analysis,Himalayan Publishing House, New Delhi, 2005.

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME :M.Sc., Chemistry **COURSE CODE : 17P2CMC6**

COURSE TITLE : Physical Chemistry-II **QN.NO : 8707**

TIME : 3 Hours **MAX.MARKS :75**

UNIT I GROUP THEORY

Rules of group -symmetry elements and symmetry operations – various operations with illustrations - matrix representation of symmetry operations - classification of groups - symmetry point groups - Groups and their basic properties — rotational (C), dihedral (D), tetrahedral (Td) and octahedral (Oh) point groups. Order of a group. Classes and similarity transformation - Group multiplication table(C_{2v}, C_{3v} and C_2h) –. Reducible and irreducible representations - decomposition procedure of reducible representation - Great orthogonality theorem - construction of character tables – C_2v, C_3v and C_2h point groups.

UNIT II APPLICATIONS OF GROUP THEORY

Direct products- definition –types- triple product principle – Reduction formula- group theoretical analysis of IR and Raman active vibrations of H_2O and NH_3 Mutual exclusion principle – N_2F_2 selection rules for IR, Raman- symmetries of Molecular Orbitals - Application of group theory to electronic transitions to formaldehyde and ethylene - - selection rules – Formation of hybrid orbitals in molecules like BF_3, $[PtCl_4]^{2-}$ and CH_4.

UNIT III CHEMICAL KINETICS I

Simple collision theory – modification-Absolute reaction rate theory (ARRT)-Statistical and thermodynamics formulation- Comparison of ARRT with collision theory-Significance of entropy of activation-Relation between ΔH and Ea-Transmission co-efficient-ARRT of termolecular reactions- Unimolecular reactions- Lindemann, Hinshelwood, RRKM and Slater treatments. Solution kinetics- ARRT of reaction in solution- primary and secondary - Salt effects.

UNIT IV CHEMICAL KINETICS II

(a) *Chain reactions* - general characteristics, kinetics of chain reactions - steady state approximation - H_2 - Br_2 – reaction, Rice - Herzfeld mechanisms for the decomposition of ethane and acetaldehyde General characteristics of branched chain reactions explosion limits - H_2-O_2- reaction.

(b) *Fast reactions* - flow techinque - continuous and stopped flow methods - relaxation methods - pressure - jump and temperature - jump methods.Complex reactions – opposing, consecutive and parallel reactions.

P.T.O.

UNIT V STATISTICAL THERMODYNAMICS

Need for statistical thermodynamics – Definition of state of a system – assembly – ensemble-canonical and micro canonical ensembles – phase space – microstate – probability and distribution. Boltzman distribution law- Bose - Einstein and Fermi-Dirac distribution laws - derivation-partition function- Translational, rotational, vibrational and electronic partition funtions. Thermodynamic properties from partition functions for energy, heat capacity and entropy, Helmholtz free energy, pressure and chemical potential. Sackur-Tetrode equation-Thermodynamic properties of monoatomic gases.

Text Book(s):

1. Cotton, F.A., "Chemical Applications of Group Theory", Third Edition, Wiley Eastern Ltd., New Delhi, 2011.
2. Ramakrishnan, V. and Gopinathan, M.S., "Group Theory in Chemistry", Third Edition, Vishal Publication, New Delhi, 2011.
3. Atkins, P. and de Paula, J., "Physical Chemistry", Ninth Edition, Oxford University Press, New Delhi, 2011.
4. Berry, R.S., Rice, S.A and Ross. J, "Physical Chemistry", Second Edition, Oxford University Press, New York, 2007.
5. Laidler, K.J. "Chemical Kinetics" Sixth Edition, Pearson Education, New Delhi, 2011.
6. Rajaram, R. and Kuriacose, J.C., "Kinetics and Mechanism of Chemical Transformation", First Edition, Macmillan India Ltd., New Delhi, 2006.

Reference Books:

1. Ball, D. W., "Physical Chemistry", First Indian Edition, Cengage Rearing India Pvt., Ltd., New Delhi, 2009.
2. Mortimer, R.G. "Physical Chemistry", Third Edition, Academic Press – An imprint of Elsevier, London, 2009.
3. Puri, B.R., Sharma, L.R. and Pathania, M.S., "Principles of Physical Chemistry", Forty sixth Edition, Vishal Publishing Co., Jalandhar, 2013.
4. Bhal, A., Bhal, B.S. and Tuli, G.D., "Essentials of Physical Chemistry", First Edition, S.Chand & Company Ltd., New Delhi, 2012.

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME :M.Sc., Chemistry **COURSE CODE : 17P2CME2**

COURSE TITLE : Bio Chemistry-II **QN.NO : 8708**

TIME : 3 Hours **MAX.MARKS :75**

UNIT I BIO-INORGANIC CHEMISTRY I

Transport proteins, oxygen carriers in various bio systems. Porphyrin system-metalloporphyrins. - hemoglobin- myoglobin – structure and work functions. Bohr effect, cooperativity - Perurtz machanism, synthetic oxygen carriers. Cytochromes and their classification, Structure and work functions in respiration etc. Copper containing proteins and their classification – Blue copper proteins, role of cytochrome C oxidase and Cyt P –450. Non-heme iron proteins-rubredoxin and various ferridoxins.

UNIT II BIO-INORGANIC CHEMISTRY II

Chlorophyll –structure -photosynthetic sequence – salient features of photosynthetic process. Corrin system, vitamin B_{12} and B_{12} coenzymes and their structures. Role of B_{12} coenzymes. *In-vivo and in-vitro* nitrogen fixation – structure and function of nitrogenase. Zinc enzymes-carbonic anhyhdrase, carboxy peptidase and superoxide dismutase, structure and mechanism of their action, enzyme action – inhibition and poisoning. Essential and trace elements in biological system-metal ion toxicity and detoxification.

UNIT III MEDICINAL CHEMISTRY - BASIC PERCEPTIONS

Concept of drug, lead compound and lead modification, prodrugs and soft drugs - Structure Activity Relationship (SAR), Quantitative Structure Activity Relationship (QSAR) – isosterism and bio- isosterism – Induced fit theory of drug activity – Concepts of drug receptors – elementary treatment of drug receptor interactions – Physicochemical parameters – lipophilicity, partition coefficient, steric and electronic ionization constants – Factors affecting modes of drug administration, absorption, metabolism and elimination – significance of drug metabolism in medicinal chemistry.

UNIT IV NUCLEIC ACIDS

Introduction – Definition - Chemical and enzymatic hydrolysis of nucleic acids – Structure and function of mRNA, tRNA, rRNA – Polymorphic nature of DNA, B- and Z- DNA, multi-stranded DNA – DNA sequence determination by chemical and enzymatic methods, Genetic code – origin, salient features, wobble hypothesis – Gene expression – transcription and translation – Gene mutation and carcinogenesis.

UNIT V NANO CHEMISTRY

Nano material: Introduction – definition- 0D, 1D, 2D, and 3D Nanomaterial and examples. Preparation of simple nanomaterials (nanometal, Metal oxide, semiconductor) – Chemical reduction method – Sputtering coating method – Sol-gel method and chemical vapour deposition method.

P.T.O.

Properties: Size effect – Colour – Magnetic properties
Characterization: Principles and applications of Scanning electron microscope (SEM) – Transmission electron microscope (TEM) – Atomic force microscope (AFM).
Carbon nano structures: Preparation, properties and application of Single-walled carbon nanotube and Multi-walled carbon nanotubes.

Text Book(s):

1. Huheey, J.E. Keiter, E.A. and Keiter, R.L. Inorganic Chemistry Principles of Structure and Reactivity (4th edition): Pearson Education Inc.,2006.
2. Shriver, D.F., Atkins, P.W. and Langford, C.H. Inorganic Chemistry, 3rd edition, Oxford Univ. Press, 1999.
3. Lehninger, A.L., "Principles of Biochemistry", Second Edition, CBS Publications, New Delhi, 2002.
4. Faber, K., "Biotransformations in Organic Chemistry", Fifth Edition, Springer, New York, 2008.
5. Burger, A. Medicinal Chemistry, Parts I & II, Wiley, N.Y., 1970.
6. Purcell, K.F. and Kotz, J.C. Inorganic Chemistry, W.B. Saunders Company,(1977
7. Stryer, L. Biochemistry, IV Edn., Freemann and Company, New York (1995).
8. Nelson, D.L. and Cox, M.M. Lehninger Principles of Biochemistry, 5th edition Freemann and Company, New York (2011).
9. Pradeep, T Understanding nanoscience and nanotechnology.

Reference Books:

1. Jain, J.L., "Fundamentals of Biochemistry", Fourth Edition, S. Chand & Company Limited, New Delhi, 2011.
2. Holum, J.R. Introduction to organic and biological chemistry, John Wiley, N.Y. 1969.
3. Charles P. Poole Jr, Frank J. Owens. Introduction to nanotechnology.
4. Taylor, J. B. and Kennewell, P.D. Introduction to Medicinal Chemistry, Ellishorwood, West Sussex, 1981.
5. Chatwal, G.R. Synthetic Drugs, Himalaya Publishing House, Bombay, 1986.
6. Hussain Reddy, K. Bioinorganic chemistry New Age Publishers New Delhi, (2009).

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THE MADURA COLLEGE (Autonomous), MADURAI – 625 011
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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : M.Sc., Chemistry **COURSE CODE : 17P3CMC7**

COURSE TITLE : Organic Chemistry-II **QN.NO : 8712**

TIME : 3 Hours **MAX.MARKS :75**

UNIT 1 SPECTROSCOPY-I

(a) *UV Spectroscopy*: Principle- types of electronic excitation, Woodward-Fieser rules for conjugated polyenes, enones, Scott rules for some substituted aromatic compounds; factors affecting the position and intensity of lambda -structure, solvent and shift reagents
(b) *IR Spectroscopy*: Vibrational frequency- Factors affecting the group frequencies - hydrogen bonding, electronic and steric effect, Fermi resonance –finger print region, FT-IR
(c) *ORD and CD*: Definition, deduction of absolute configuration, octant rule for ketones.

UNIT II SPECTROSCOPY-I

a)*^{1}H NMR spectroscopy*: Principle - TMS as internal standard-Relaxation process - Chemical shift-nmr scales; Number, intensity & position of signals - Factors affecting the chemical shift ; spin-spin coupling, coupling constant; spin-spin splitting-lanthanide shift reagents, Proton exchange, deuterium exchange and the influence of restricted rotation.
(b) *^{13}C NMR spectroscopy* : Basic principle of FT technique - Relaxation time, assignment of signals; Off-resonance decoupling- double resonance-spin tickling, Nuclear-Overhauser Effect and CIDNP; DEPT ^{13}C spectra, ^{13}C- ^{13}C CORRELATION, INADEQUATE, COSY, HETCOR, ROESY, NOESY and TOCSY.
(c) *Mass Spectrometry*: Principle-types of ions –molecular, isotopic, metastable; Base peak; Nitrogen rule; Fragmentation modes; Retro Diels-Alder reaction, McLaffety rearrangement.

UNIT III PERICYCLIC REACTIONS

Molecualr orbital symmetry, Frontier orbitals of ethylene,1,3- butadiene, 1,3,5 –hexatriene and allyl system. Classifiaction of pericyclic reactions. Woodward-Hoffmann correlation diagrams. 4n and 4n+2 systems, FMO and PMO approach. Electrocyclic reactions – *con* rotatory and *dis* rotatory ring closure - 2+2 addition of ketenes, 1,3- dipolar cycloadditions and cheleotropic reactions.
Sigmatropic reaarangements - suprafacial and antarafacial shifts of H, sigmatropic shifts involving carbon moieties, 3,3- and 5,5- sigmatropic reaarangements. Claisen, Cope and aza-Cope rearrangements. Fluxional tautomerism, ene reaction.

UNIT IV PHOTOCHEMISTRY

Photochemistry: n to π^* and π to π^* transitions - allowed and forbidden,
Intramolecular reactions of the olefinic bond - geometrical isomerism, cyclisation reaction, rearrangement of 1,4 and 1,5 dienes.
Photochemistry of carbonyl compounds - intramolecular reactions of carbonyl compounds: Norrish type I & type II, Paterno-Buchi reaction, saturated cyclic and acyclic - α, β and β, γ-unsaturated compounds.
Photochemistry of aromatic compounds - Isomerization, addition and substitution.
Miscellaneous photochemical reactions - Barton reaction, photo-Fries rearrangement, Hofmman Freytag reaction.

P.T.O.

UNIT V REAGENTS

Principle, preparations, properties and applications of the following in organic synthesis:
Organometallic reagents: Organolithium compounds (PhLi & BuLi), Organocopper compounds (Lithiumorgano cuprates), Organocadmium compounds, Organomercury compounds (Mercuric acetate),
Phosphorous containing reagents: (Phosphorous ylides), Sulfur containing reagents: (dimsyl anion, diphenyl sulfide, dithioacetals, Julia reaction), Silicon containing reagents: (Peterson reaction, trimethylvinyl silane, Trimethylsilyl chloride, aryl and alkenyl silanes), Boron containing reagents: (diborane, organoborane, 9-BBN, Corey-Nicolaou reagent)
Transition metal compounds: Titanium reagents: (Tebbe reagent, Ziegler's catalyst), Organochromium compounds, Iron compounds: (Acyl iron complexes), Cobalt compounds: (Hydroformylation, Pauson-Khand reaction), Rhodium compounds: (Wilkinson catalyst), Palladium compounds: (Pd II complexes).
Other reagents: DDQ, DCC, NBS, OsO_4.

Text Book(s):

1. Kemp, W., "Organic Spectroscopy", Third Edition, Replica Press Pvt. Ltd., New Delhi, 2008.
2. Silverstein, R.M., Bassler, G.C. and Morrill, T.C., "Spectroscopic Identification of Organic Compounds", Sixth Edition, Wiley Ind. Ltd., Singapore, 2006.
3. Depuy, E.C.H. and Chapman, O.S., "Molecular Reactions and Photochemistry", Prentice Hall, New York, 1988.
4. Norman, R. O. C., Coxon, J. M. Principles of Organic Synthesis, and Blackie Academic & Professional, 1988.
5. March, J., "Advanced Organic Chemistry", Sixth Edition, John Wiley & Sons, New York, 2007.

Reference Books:

1. Mohan, J., "Organic Spectroscopy (Principles and Applications)" Second Edition, Narosa Publishing House, New Delhi, 2004.
2. Kalsi, P. S., Spectroscopy of Organic Compounds, Wiley Esternj Ltd., New Delhi, 1993.
3. Singh, J. and Singh, J., "Photochemistry and Pericyclic Reaction", First Edition, New Age International, New Delhi, 2004.
4. Ahluwalia, V.K. and Parashar, R.K., "Organic Reaction Mechanism" Fourth Edition, Narosa Publishing House, New Delhi, 2011.
5. Kalsi, P. S. Organic Reactions and their Mechanisms, New Age International Publishers, New Delhi, 1996.

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME :M.Sc., Chemistry **COURSE CODE : 17P3CMC8**

COURSE TITLE : Inorganic Chemistry-II **QN.NO : 8713**

TIME : 3 Hours **MAX.MARKS :75**

UNIT I INTRODUCTION TO CO-ORDINATION CHEMISTRY

Introduction – IUPAC nomenclature- co-ordination numbers- Isomerism- structural, geometrical and optical isomerism in square planar and octahedral complexes. Chelating ligand, chelate effectand its application, stability of complexes – complex equilibria – determination of stability constant- Spectrophotometric- Job's variation - Potentiometric methods. factors affecting stability constants. Irving-William series.

UNIT II THEORY OF CO-ORDINATION COMPONDS.

Valence bond theory. Crystal field splittings in octahedral, tetrahedral, square pyramidal, trigonal bipyramidal and square planar geometries-Consequences of crystal field splitting on thermo dynamic, magnetic and spetroscopic properties. Applications of CFT, spectrochemical series-Nephelauxetic effect. Jahn-Teller effect. Inadequacy of CFT. The molecular orbital theory-octahedral, tetrahedral and square planar geometries. Experimental evidences for covalence in metal-ligand bonding.

UNIT III ELECTRONIC SPECTRA OF COMPLEX

Atomic Term Symbol: Ground and higher states — methods of determining ground state term and complete terms –Pigeon hole diagram and Russel-Saunder microstates method for p^2 and d^2 configuration - term symbols for non- equivalent electrons.

A detalied survey of the electronic spectra of octahedral,tetrahedral and square planar complexes of transition metals-(i) effect of spin orbit coupling ii) Jahn-Teller distortions and its effect on the structure and spectrum , the nephelauxetic effect and the nephelauxetic series-Calculation of Dq,B,C from the spectrum. Orgel and Tanabe-Sugano diagrams and evaluation of 10Dq and beta for octahedral complexes of d^3, d^8 and tetrahedral complexes of d^2, d^7 configurations. Charge transfer spectra of complexes-ligand to metal, metal to ligand types and metal to metal type.

UNIT 1V NUCLEAR MAGNETC RESONANCE

^{1}H,^{13}C,^{19}F and ^{31}P – NMR. Applications to inorganic compounds - NMR of paramagnetic complexes. Contact and pseudo contact interactions- structures of metal complexes-shift reagents structural problems of the compounds like $CFCl_3$, SF_4, PF_5, BrF_5, H_2PF_3, $PF_3(NH_2)_2$, P_4S_3, *mer* and *fac*- $Rh(PPh_3)_3Cl_3$, *cis* and *trans*-$[PtCl_2(PBu_3)(PPh_3)_3]$. Fluxional behavior of complexes.

Electron spin resonance: Spin-Hamiltonian, ESR phenomenon - hyperfine interactions-spin-orbit coupling- ESR spectra of D and F states in octahedral fields (Zero field splitting and Kramers degeneracy)- determination of the ground states of complexes.EPR spectra of transition metal ions complexes like bis(salicylaldimine)copper(II), $Co_3(CO)_9Se$, $[(NH_3)_5Co\text{-}O_2\text{-}Co(NH_3)_5]^{5+}$, NH_2 radical and Mn^{2+} complexes – representative spectra of different d^n systems – evaluation of spin – orbit coupling.

UNIT V PHOTOELECTRON AND MOSSBAUER SPECTROSCOPY

PES : Theory of XPES, UVPES – evaluation of ionisation potential – chemical identification of elements – ESCA – Koopmann's theorem – chemical shift – UPES of NH_3, N_2, O_2, CO, H_2O and HCl – vibrational fine structure and their origin – evaluation of vibrational constants from UPES – spin-spin coupling - spin-orbit coupling.

Mössbauer spectroscopy: Discovery - Nuclei suitable for Mössbauer experiment - Hyperfine interactions - isomershifts quadrupole splitting & magnetic hyperfine splitting - temperature effects - applications of Mössbauer spectoscopy to compounds & complexes of Fe & Sn.

Text Book(s):

1. Ballhausen, C.J., Introduction to ligand field theory, Mc GrawHill, New York, 1962.
2. Figgis, B.N., Introduction to ligand fields, John Wiley & Sons Ltd., London and New York 1966.
3. Kettle, S.F.A., Coordination compounds, Thomas Nelson and Sons,. Ltd., London, 1969.
4. Thomas M.Dunnand McClure and Pearson, "Some aspects of crystal theory fields, Harper-Row, New York, 1965.
5. Ballhanusen, C.J.,andHzry.B.Grey, "Molecular orbital theory" A Lecture note ReprintVolume,W. A. Benjamin, Inc. , New York, 1965.
6. Drago, R.S., Physical methods in chemistry,W.B.Saundar, 1977.
7. Cotton, F.A., and Wilkinson, Advanced Inorganic Chemistry,John Wiley & Sons Ltd.,London-New York, 1972.
8. Cotton, F.A., "Chemical Applications of Group Theory", Third Edition, Wiley Eastern Ltd., New Delhi, 2011.
9. Lever, A.B.P., Inorganic electronic Spectroscopy, Second Edition, Elsevier, Amsterdam, Oxford, New York, Tokio 1984.
10. Sutton,D., Electonic spectra of metal complexes, Second Edition McGraw-Hill, New York, 1968.
11.Figgis,B.N., Transition metal chemistry, volume IX, Marcel Uekker, Inc., Basel, 1982;
12. Hill, H. A. O., Day, P., Advanced Inorganic Chemistry, Darl H. McDaniel. J. Chem. Educ. , 1969
13. Ebsworth, E. A., David W. H. Rankin, Cradock**,** S.,Structural methods in Inorganic chemistry, ELBS.,CrcPr I Llc., 1991.
14. Purcell, K.F., Kotz J.C., Saunders W.B., Inorganic chemistry, Saunders College Publishing, Philadelphia, 1980.
15. Mabbs, F. E., Machin, D. J., Magnetism and transition metal complexes, John Wiley & Sons, Incorporated, 1973.

Reference Books:

1. Sutton, D., Electonic spectra of metal complexes, Second Edition, McGraw-Hill, New York, 1968.
2. Hill and Day, Advanced Inorganic Chemistry, First edition, John Wiley & Sons Ltd.,1968.
3. Walker,S., Straughan, B. P. SpectrocopyvolumeI, II & III, chapmen and Hall, 1976.
4. Figgis,B.N.,Transition metal chemistry, volume IX, Marcel Uekker, Inc., Basel, 1982
5. Semen, A. A., Boris M.K., Electron spin resonance, Wiley, 1974
6. Rao,CNR., andFeraro,J R.Inorganic spectroscopy, volume I&II, Academic press, New York, 1971.
7. Carrington, A., McLachlan, A. D. Introduction toMagnetic Resonance, Harper and Row, New York, 1967.
8. Carrington, McLachlan A.D., Introduction to Magnetic Resonance: With Applications to Chemistry and Chemical Physics, Harper& Row, New York ,1979.
9. Boudreaux, F.A., andMuley, L.N., Theory and application of molecular paramagnetism,John Wiley & Sons, Inc., New York, 1976
10. Nakamoto, Infrared and Raman Spectra of Inorganic and Coordination Compounds, Wiley–Interscience, Fourth edition, 1998.
11. Vertes, A., and Burger, K., Mossbauer Spectroscopy, Elsevier, Amsterdam, 1979.
12. Gibbs, T.C., Mossbauer Spectroscopy, Chapman and Hall, London, 1977.
9. F.A. Boudreaux & L.N. Muley: Theory and application of molecular paramagnetism. John – Wiley
10. Nakamoto : Infrared and Raman Spectra of Inorganic & Coordination Compounds Wiley - Interscience IV Edn.
11. A. Vertes & K. Burger Mossbauer Spectroscopy Elsivier
12. T.C. Gibbs Mossbauer Spectroscopy Chapman - Hall

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : M.Sc., Chemistry **COURSE CODE : 17P3CMC9**

COURSE TITLE : Physical Chemistry-III **QN.NO : 8714**

TIME : 3 Hours **MAX.MARKS :75**

UNIT I MOLECULAR SPECTROSCOPY - I

Electromagnetic radiation – interaction of electromagnetic radiation with matter – types of molecular spectroscopy – molecular energy levels – Einstein's transition probability – spectral line intensity – emission and absorption spectroscopy - Microwave spectroscopy: rotation of molecules – rotational spectra of rigid rotator – selection rule - intensities of rotational lines - effect of isotopic substitution - – rotational spectra of non rigid rotator - Applications : Calculation of moment of inertia, bond length and atomic mass from microwave spectra- classification of molecules based on moment of inertia.

Infrared spectroscopy: Spectra of diatomic molecules – instrumentation – selection rule – harmonic and an harmonic oscillator - fundamental bands – P,Q and R branches – overtones – hot bands- fundamendal vibrational modes of H_2O and CO_2.

UNIT II MOLECULAR SPECTROSCOPY - II

Raman spectroscopy: classical and quantum theory of Raman effect - Stokes and antistokes line – experimental aspects – polarisability – selection rule – diatomic molecules – pure rotational Raman spectrum – s-branch – application – determination of internuclear distance – mutual exclusion principle – Fermi resonance – Laser Raman Spectra.

Electronic spectra of diatomic molecules- Born-Oppenheimer approximation - coarse structure – Frank-Condon principle - dissociation energy - calculation - Birge- Sponer extrapolation technique, pre-dissociation spectra- Fortrat diagram- Electronic spectra of molecules.

UNIT III NMR SPECTROSCOPY

Nuclear magnetic moment – nuclear spin states and nmr active nuclei, mechanism of resonance absorption applied field and its interaction -chemical shift and shielding.Nuclear spins in a magnetic field– Zeeman effect -Larmor precession - resonance – bloch equation – spin-lattice and spin-spin relaxation times – nuclear shielding and chemical shift - spin-spin coupling - line width - MRI basic concept - basic principle of FT-NMR spectroscopy – ^{13}C NMR – basic principle and experimental techniques.

UNIT IV ELECTRON SPIN RESONANCE AND PHOTOELECTRON SPECTROSCOPY

ESR – principle – presentation of spectrum- EPR spectrum of hydrogen atom -g-factor-hyperfine spilitting; nuclear pin (I = ½, 1, 3/2, 5/2)interaction with electron – epr spectra of organic radicals (Hydrogen atom, methyl radical, 1,4-benzosemiquinone radical anion, naphthalene negative ion, triphenyl methyl radical) zero field splitting - Kramer's degeneracy- applications.

Photoelectron spectroscopy- basic principles, spectrum, X-ray PES, ESCA- Vibrational structure- Koopman's theorem- PES of argon, oxygen and nitrogen.

P.T.O.

UNIT V PHOTOCHEMISTRY

Introduction – Physical properties in electronically excited molecules - Jablonski diagram -. Photophysical processes in electronically excited molecules: Intersystem crossing, internal conversion, fluorescence, phosphorescence and other deactivation processes – determination of excited state dipole moment, acidity constant - Photophysical kinetics of unimolecular and bimolecular processes – delayed fluorescence – Stern-Volmer equation and its applications – photosensitisation – chemiluminescence – bioluminescence - experimental techniques – actinometery – elementary idea of photosynthesis - Laser .

Text Book(s):

1. Banwell, C.N. and Mc Cash, E.M. "Fundamental of Molecular Spectroscopy", Fifth Edition, Mc Graw Hill Education (India) Pvt., Ltd., New Delhi, 2013.
2. Atkins, P. and de Paula, J., "Physical Chemistry", Ninth Edition, Oxford University Press, New Delhi, 2011.
3. Ball, D. W., "Physical Chemistry", First Indian Edition, Cengage Rearing India Pvt., Ltd., New Delhi, 2009.
4. Mortimer, R.G. "Physical Chemistry", Third Edition, Academic Press – An imprint of Elsevier, London, 2009.
5. Engel, T. and Reid, P., "Physical Chemistry", Second South Asian Edition, Pearson Publication, New Delhi, 2011.
6. Berry, R.S., Rice, S.A and Ross. J, "Physical Chemistry", Second Edition, Oxford University Press, New York, 2007.
7. Rohatgi - Mukerjee, K.K. "Fundamentals of Photochemistry", Second Edition, Wiley Eastern Ltd, New York, 2011.

Reference Books:

1. Aruldhas, G. "Molecular Structure and Spectroscopy", First Edition, Prentice-Hall of India Pvt. Ltd., New Delhi, 2005.
2. Puri, B.R., Sharma, L.R. and Pathania, M.S., "Principles of Physical Chemistry", Forty sixth Edition, Vishal Publishing Co., Jalandhar, 2013.
3. Bhal, A., Bhal, B.S. and Tuli, G.D., "Essentials of Physical Chemistry", First Edition, S.Chand & Company Ltd., New Delhi, 2012.

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PROGRAMME :M.Sc., Chemistry **COURSE CODE : 17P3CNM1**

COURSE TITLE : Chemistry and its Applications **QN.NO : 8715**

TIME : 3 Hours **MAX.MARKS :75**

UNIT I SMALL SCALE UNITS

Safety matches – Agarbattis - Naphthalene balls - Wax candles - Shoe polish - Gum paste - Writing /Fountain pen ink - Chalk (Rayons - Plaster of paris).
Basics of Chemistry: Periodic table – electronic configuration-classification of elements on the basis of electronic configuration - Oxidation number (Eg. $KMnO_4$, $K_2Cr_2O_7$, H_2SO_4, CO_2, SO_3, NH_3) – oxidation - oxidising agents with example - Reduction – Reducing agent with example.

UNIT II CORROSION
Corrosion – definition - rusting of iron with examples – protection methods of corrosion-anodicprotection – Soaps – Detergents - Paints – acrylic emulsion paints – varnishes.

UNIT III POLLUTION
Pollution: Introduction – pollution – definition- classification – Air pollution – air pollutants – acid rain – green house effect – ozone layer depletion – control of air pollution – water pollution – effects of impurities in water – Sewage, industrial effluents (textile/leather).

UNIT IV POLYMERS
Monomer – polymer – definition – classification – thermoplastic – thermosetting – differences between the thermoplastics and thermosetting polymers - polymerization – addition polymer- condensation polymer (Rubber, PVC, polyethylene, nylon-66-Terylene and Bakelite).

UNIT V WATER TREATMENT
Water: Source of water – characteristics of water – Hardness of water – Types – Temporary hardness – permanent hardness – disadvantages of hard water – Removal of hardness – Reverse osmosis – zeolite process.

Text Book(s):

1. Sharma, B. K., Industrial chemistry, Goel Puplisihing House, 1994.
2. Charrabarthy B.N., Industrial Chemistry, Oxford and IBH Publishing co. Pvt. Ltd. 1981.
3. Jain, P. C., Jain, M. Enginering chemistry, 15th edition., 1998.

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME :M.Sc., Chemistry **COURSE CODE : 17P4CMC10**

COURSE TITLE : Organic Chemistry-II **QN.NO : 8716**

TIME : 3 Hours **MAX.MARKS :75**

UNIT I TERPENOIDS AND FLAVONES

Terpenoids: Classification, nomenclature, occurrence, Isolation, general methods of structure determination, isoprene rule, Structural determination, stereochemistry and synthesis of the following representative molecules: menthol, zingiberene and abietic acid.
Anthocyanins and flavones: Flavonoids: general method of structural determination. General nature of anthocyanins - synthesis of flavones chalcone, and anthocyanidiens. Structural elucidation of caffeine.

UNIT II STEROIDS

Occurrence, nomenclature, basic skeleton and stereochemistry isolation, structure determination and synthesis of cholesterol, equilenin, Androsterone, Testosterone, Estrone, Progesterone, Biosynthesis of steroids.

UNIT III HETEROCYCLES

Nomenclature, aromatic heterocycles - heteroaromatic reactivity and tautomerism in aromatic heterocycles, Non-aromatic heterocycles - conformation, stereo electronic effects, heterocyclic synthesis - cyclization reactions and cycloaddition reactions, small ring heterocycles - oxiranes, aziridines, pyridine.
Benzo- fused five membered heterocycles: Indole, benzofurans, benzothiophenes.

UNIT IV ALKALOIDS AND PROSTAGLANDINS

Alkaloids: Definition, nomenclature and physiological action, occurrence, isolation, general methods of structural elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants - Structure, stereochemistry and synthesis of the following: quinine, nicotine and morphine.
Prostaglandins: Occurrence, nomenclature ,classification, biogenesis and physiologiical effects. Synthesis of PGE_2 and $PGF_{2\alpha}$

UNIT V CARBOHYDRATES AND GREEN CHEMISTRY

Conformation of monosaccharides, structure and functions of some important derivatives of amino sugars, glycosides. Disaccharides: Sucrose. Polysaccharides: cellulose, starch. Carbohydrate metabolism –Kreb's cycle, glycolysis.
Green chemistry: Importance -12 principles of green chemistry - solid state and solvent free organic reactions – using supported reagents- microwave radiations- ionic liquids.

P.T.O.

Text Book(s):

1. Finar, I.L., “Organic Chemistry”, Vol. II, Sixth Edition, Pearson Education Pvt. Ltd., Singapore, 2006.
2. Joule, J.A. and Mills, K., “Heterocyclic Chemistry”, Fourth Edition, Blackwell Publishing Company, New York, 2004.
3. Sanghi, R. and Srivastava, M.M., “Green Chemistry (Environmental Friendly Alternatives)”, First Edition, Narosa Publishing House, New Delhi, 2003.

Reference Books:

1. Bansal, K., “Heterocyclic Chemistry”, Fourth Edition, New Age International, New Delhi, 2005.
2. Ahluwalia, V.K., “Chemistry of Natural Products”, First Edition, Vishal Publishing Co, Jalandhar, 2008.
3. Desai, K. R., “Green Chemistry (Microwave Synthesis)”, First Edition, Himalaya Publishing House, Mumbai, 2005.
4. Ahluwalia, A.K., “Green Chemistry (Environmentally Benign Reactions)”, First Edition, Aru Books India, New Delhi, 2006.
5. Jain, R.; Sahay, A.; Soni, U.; Pimplapure, S. Heterocyclic compounds, Pragati Prakashan, First edition, 2015.

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME :M.Sc., Chemistry **COURSE CODE : 17P4CMC11**

COURSE TITLE : Inorganic Chemistry -IV **QN.NO : 8717**

TIME : 3 Hours **MAX.MARKS :75**

UNIT I KINETICS AND MECHANISM OF COORDINATION COMPOUNDS

Substitution reactions - lability - inertness - substitution in octahedral complexes – Acid hydrolysis, base hydrolysis - anation reaction - square planar substitution reactions - factors affecting reactivity of square planar complexes - trans effect, theories of trans effect mechanisms of electron transfer reaction – outer and inner spheres reactions. Complementary and non- complementary reactions.

UNIT II INORGANIC PHOTOCHEMSITRY

Excited states of coordination complexes - properties of excited states - photochemical pathways - energy transfer and charge transfer in photo chemistry - photoredox reaction - photo substitution reactions. Photoanation, photo aquation, photo rearrangement. Ruthenium polypyridyls - chromium polypyridyls.Photo chemical reactions of complex. Role of TiO_2 in solar energy conversion - Photochemical conversion and storage of solar energy.

UNIT III LANTHANIDE AND ACTINIDES

The chemistry of lanthanides and actinides: Comparative study of lanthanide and actinide and comparative study of f and d block elements. Extraction of lanthanides from monazide minerals. Separation of lanthanides – Modern technique -ion exchange method, solvent extraction and paper chromatography. Lanthanide contraction and its consequence-Oxidation state; colour, spectral and magnetic properties - nuclear and non-Nuclear applications. Actinides contraction –separation of actinides-Ion-exchange methods. Applications of actinides.

UNIT IV ORGANOMETALLIC CHEMISTRY

Introduction – EAN rule -importance of 18 and 16 electron rule in organometallics and its correlation to stability–metal carbene and carbyne complexes. Synthesis, structure and bonding in metal carbonyls, poly carbonyls, nitrosyls and dioxygen. IR study of metal carbonyls. Isolobal fragments. Synthesis, structure and bonding in π-complexes formed by olefin, acetylene, cyclopentadienyl complexes.

P.T.O.

UNIT V ORGANOMETALIC CATALYSIS

Oxidative addition, reductive elimination, insertion reaction (migration) and β - elimination. Catalytic mechanism in the following reactions: Homogeneous and hetrogenous catalysis- Hydrogenation of olefins (Wilkinson's catalyst) – Tolman catalytic loops – hydroformylation (oxo process) – acetic acid from methanol – oxidation of alkenes to aldehydes and ketones (Wacker process) – synthetic gasoline (Fischer – Tropsch and Mobile process – olefin polymerisation (Ziegler – Natta catalyst) – cyclo oligomerisation of acetylenes (Reppe's or Wilke's catalyst).

Text Book(s):

1. James Huheey, Inorganic Chemistry, Fourth edition, Harper – Collins, New York, 1993.
2. Cotton, F.A., Wilkinson, G., Murillo, C.A. and Bouchmann, M., "Advanced Inorganic Chemistry", Sixth Edition, John Wiley & Sons (Asia), Singapore, 2004.
3. Basolo, F. and Pearson, R.G., "Mechanism of Inorganic Reaction", Second Edition, Wiley, New York, 1967.
4. Emeleus, H.J., and Sharpe, A., Modern Aspects of Inorganic chemistry, Fourth Edition, Routledge and Kegan Paul, United Kingdom, 1975
5. Beck, M.T., Chemistry of complex equilibria, Ellis Horwood series in inorganic chemistry, Second. Edition,Van Nostrand, 1970.
6. Rossotti, H., The study of Ionic equilibria, Longman, London, 1978.
7. Moeller, T., Chemsitry of Lanthonides and Actinides, Pergamon Press, Oxford, 1973.
8. Barnard, A.K., Theoretical basis of Inorganic Chemsitry, Tata-McGrawhill, New York, 1965.
9. J.C.Bailar Ed. Comprehensive Inorganic chemistry, Vol V, Pergamon Press, Oxford, 1973.
10. William PorterField, Inorganic Chemistry- A unified approach, Academic Press inc.,Elsevier, London, 1993.
11. Geoffery, G.L., Weighton M.S., Organic Metallic photochemistry Academic,Academic, New York, 1979.

Reference Books:

1. D. Benson Mechanism of inorganic reactions in solutions, McGrawHill, London, 1968.
2. Langford, C.H., and Gray, H.B., Ligand substituionprocesses, Benjamin, Inc. , New York, 1966.
3. Adamson, S., "Concept of Inorganic Photochemistry", Fifth Edition, John Wiley & Sons (Asia) Pvt. Ltd., Singapore, 1975
4. C.J. Ferradi - Elements of Inorganic Photo chemistry, John Wiley & Sons, NewYork, 1975.

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THE MADURA COLLEGE (Autonomous), MADURAI – 625 011
(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)
RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME :M.Sc., Chemistry **COURSE CODE : 17P4CMC12**

COURSE TITLE : Physical Chemistry -IV **QN.NO : 8718**

TIME : 3 Hours **MAX.MARKS :75**

UNIT I ELECTROCHEMISTRY – I

Theory of strong electrolytes, Interionic attraction theory- Debye-Huckel model of ionic atmosphere- Debye-Huckel Onsager equation-derivation, verification and modifications- Wien effect – Debye Falkenhagen effect - Debye Huckel limiting law-extension- Huckel Bronsted equation- Determination of activity coefficients using Bronsted equation. - concept of activity and activity coefficient, Activities in electrolytic solutions - ionic strength –- mean molal ionic activity coefficient of strong electrolytes - calculations.

UNIT II ELECTROCHEMISTRY- II

Electrical double layer - Theories of electrical double layers – Helmholtz model – Chapmann model – Stern model - electrode processes - Kinetics of electrode processes - Butler-Volmer equation- Tafel equation - Over voltage- theories of over voltage - application of over voltage- - Corrosion- principles of electrochemical corrosion- Dry and wet corrosion and its mechanism. Types of corrosion- Galvanic, aeration, stress, pitting corrosion. Polarography- theory and applications- Batteries- Nickel-Cadmium, lead-acid battery - Electrochemical energy conversions. Storage and Fuel cells: Primary and Secondary Fuel cells. H_2-O_2 fuel cells and its advantages.

UNIT III NON-EQUILIBRIUM THERMODYNAMICS

Introduction - Phenomenological laws and Onsager's reciprocal relations-entropy product-ion specific examples of entropy production - Prigogine's principle of minimum entropy production - entropy production in coupled phenomena-an elementary introduction to bioenergetics

UNIT IV SURFACE CHEMISTRY

Adsorption – physisorption and chemisorption. Adsorption isotherms: BET and Gibbs adsorption isotherms. Different types of adsorption. Adsorption with dissociation – competitive adsorption – non-ideal adsorption. Thermodynamics of adsorption. Surface area determination. Kinetics and mechanism of unimolecular and bimolecular reactions – Langmuir-Hinshelwood and Langmuir-Rideal mechanisms.

UNIT V RADIATION CHEMISTRY AND CATALYSIS

Radiation chemistry: Source of high energy – interaction of high energy radiation with matter – radiolysis of water – G-value – reactions of hydrated electrons OH and H radicals – experimental techniques : Dosimetry.

Homogeneous catalysis - acid-base catalysis – protopic and protolytic mechanism - Bronsted relationships - secondary' salt effect acidity functions - Hammett's acidity function - enzyme catalysis - Michaeli's - Menten kinetics.

P.T.O.

Text Book(s):

1. Bockris, J.O.M and Reddy, AK.N., "Modern Electrochemistry 1 – Ionics", Second Edition, Springer, New Delhi, 2006.
2. Samuel Glasstone, "Electrochemistry", First Edition (Latest revised), East-West Press, New Delhi, 2010
3. Adamson, A.W. and Gast, A.P., "Physical Chemistry of Surfaces", Sixth Edition, Wiley India Pvt., Ltd., New Delhi, 2012.
4. Laidler, K.J., "Chemical Kinetics" Sixth Edition, Pearson Education, New Delhi, 2011.
5. Atkins, P. and de Paula, J., "Physical Chemistry", Ninth Edition, Oxford University Press, New Delhi, 2011.
6. Mortimer, R.G. "Physical Chemistry", Third Edition, Academic Press – An imprint of Elsevier, London, 2009.

Reference Books:

1. Viswanathan, B, Venkatraman, R, Rengarajan, K. Sundaram, S and Ragavan, P.S., "Electrochemistry", First Edition, S. Viswanathan (Printers and Publishers) Pvt. Ltd., Chennai, 2007.
2. Ball, D.W., "Physical Chemistry", First Indian Edition, Cengage Rearing India Pvt., Ltd., New Delhi, 2009.
3. Puri, B.R., Sharma, L.R. and Pathania, M.S., "Principles of Physical Chemistry", Forty eigth Edition, Vishal Publishing Co., Jalandhar, 2015.
4. Engel, T. and Reid, P.,"Physical Chemistry", Second South Asian Edition, Pearson Publication, New Delhi, 2011.
5. Berry, R.S., Rice, S.A and Ross, J., "Physical Chemistry", Second Edition, Oxford University Press, New York, 2007.

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME :M.Sc., Chemistry **COURSE CODE : 17P4CME3**

COURSE TITLE : CSIR – NET –GATE –SET **QN.NO : 8719**

Examinations Preparations

TIME : 3 Hours **MAX.MARKS :75**

UNIT I INORGANIC CHEMSITRY - I

a. Structure and bonding in homo and hetero nuclearmolecules, including shapes of Molecules (VSEPRTheory).
b. Transition elements and coordination compounds: structure, bondingtheories, spectral and magnetic properties, reaction mechanisms.
c. Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications.
d. Organometallic compounds: synthesis, bonding and structure, and reactivity, Organometallics in homogeneous catalysis.

UNIT II INORGANIC CHEMSITRY – II

a. Cagesand metal clusters.
b. Analyticalchemistry- separation, spectroscopic, electro- and thermo- analytical methods.
c. Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, electron- transfer reactions; nitrogenfixation, metalcomplexesin medicine.
d. Characterisation of inorganic compounds by IR, Raman, NMR, EPR, Mössbauer, UV-vis, NQR, MS, electron spectroscopy and microscopic techniques.
e. Atomicstructure and spectroscopy; term symbols; many-electron systems and antisymmetry principle.

UNIT III PHYSICAL CHEMISTRY

a. Basic Principles of quantum mechanics: Postulates, particle-in-a box, harmonic oscillator and the hydrogen atom including shapes of atomic orbitals; orbital and spin angular momentum tunneling.
b. Approximate methods of quantum mechanics: Variational principle; perturbation theory up to second order in energy; applications.
c. Atomic structure and spectroscopy; term symbols; many-electron systems and antisymmetry principle.
d. Chemical bonding in diatomics; elementary concepts of MO and VB theories; Huckel theory for conjugated π-electron systems.
e. Chemical applications of group theory; symmetry elements; point groups; character tables; selection rules.
f. Molecular spectroscopy: Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities – selection rules; basic principles of magnetic resonance.
g. Chemical thermodynamics: Laws, state and path functions and their applications; thermodynamic description of various types of processes; Maxwell's relations; spontaneity and equilibria; temperature and pressure dependence of thermodynamic

quantities; Le Chatelier principle; elementary description of phase transitions; phase equilibria and phase rule; thermodynamics of ideal and non-ideal gases, and solutions.

h. Statistical thermodynamics: Boltzmann distribution; kinetic theory of gases; partition functions and their relation to thermodynamic quantities – calculations for model systems.
i. Electrochemistry: Nernst equation, redox systems, electrochemical cells; Debye-Huckel theory; electrolytic conductance – Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titrations.
j. Chemical kinetics: Empirical rate laws and temperature dependence; complex reactions; steady state approximation; determination of reaction mechanisms; collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; salt effects; homogeneous catalysis; photochemical reactions.
k. Colloids and surfaces: Stability and properties of colloids; isotherms and surface area; heterogeneous catalysis.
l. Solid state: Crystal structures; Bragg's law and applications; band structure of solids.

UNIT IV ORGANIC CHEMISTRY-I

a. IUPAC nomenclature of organic molecules including regio- and stereoisomers.
b. Principles of stereochemistry: Configurational and conformational isomerism in acyclicand cycliccompounds; stereogenicity, stereoselectivity, enantioselectivity, diastereo selectivity and asymmetric induction.
c. Organic reactive intermediates: Generation, stability and reactivity of carbocations, carbocations, carbanions, free radicals, carbenes, benzynes andnitrenes.
d. Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilicor radicalspecies. Determination of reaction pathways.
e. Common named reactions and rearrangements– applications in organic synthesis.

UNIT V ORGANIC CHEMISTRY-II

a. Organic transformations and reagents: Functional group interconversion including oxidations and reductions; common catalysts and reagents (organic, inorganic, organometallic andenzymatic). Chemo, regio and stereo-selective transformations.
b. Concepts in organic synthesis: Retrosynthesis, disconnection, synthons, linear and convergent synthesis, umpolung of reactivity and protecting groups.
c. Pericyclicreactions– electrocyclisation, cycloaddition, sigmatropic rearrangements and other related concerted reactions. Principles and applications of photochemical reactions in organic chemistry.
d. Synthesis and reactivity of common heterocyclic compounds containing one or two heteroatoms (O, N, S).
e. Structure determination of organic compounds by IR, UV-Vis, ^{1}H &^{13}C NMR and Mass spectroscopic techniques.

Reference Books:

1. UGC-CSIR NET/SET (JRF&LS) Chemical Sciences Arihant publications.
2. UGC-CSIR NET/SET (JRF&LS) Chemical Sciences Upkars.
3. Adi Chemistry Online materials
4. E.S.Gilreeth-Fundamental concepts of Inorganic Chemistry Mcgraw Hill
5. Modern Inorganic Chemistry-William Jolly.
6. Concise Inorganic chemistry J.D.Lee ELBS IV edition.
7. Advanced Inorganic Chemistry Cotton & Wilkinson wiley.
8. Coulson. Valence Oxford Clarendon.

9. Inorganic chemistry Keilts Purcell & J.C. Kotz W.B.Saunders.
10. Modern Aspects of Inorganic chemistry Emeleus and Sharpe
11. C.Day and J.Selbin-Theoretical Inorganic Chemistry-II Edition.
12. James Huheey Inorganic Chemistry IV edn. Harper - Collins
13. Atkins, P. and de Paula, J., "Physical Chemistry", Ninth Edition, Oxford University Press, New Delhi, 2011.
14. Ball, D. W., "Physical Chemistry", First Indian Edition, Cengage Rearing India Pvt., Ltd., New Delhi, 2009.
15. Mortimer, R.G., "Physical Chemistry", Third Edition, Academic Press – An imprint of Elsevier, London, 2009.
16. Engel T. and Reid, P. "Physical Chemistry", Second South Asian Edition, Pearson Publication, New Delhi, 2011.
17. Berry, R.S., Rice, S.A and Ross. J, "Physical Chemistry", Second Edition, Oxford University Press, New York, 2007.
18. Puri, B.R., Sharma, L.R. and Pathania, M.S., "Principles of Physical Chemistry", Forty Sixth Edition, Vishal Publishing Co., Jalandhar, 2013.
19. Clayden, J., Greeves, N., Warren, S. and Wothers, P., "Organic Chemistry", First Edition, Oxford University Press, New York, 2006.
20. March, J., "Advanced Organic Chemistry", Sixth Edition, John Wiley & Sons, New York, 2007.
21. Smith, M. B., "Organic Synthesis", Second Edition, McGraw-Hill International Edition, New Delhi, 1994.
22. Skyes, P., "A Guide Book to Mechanism in Organic Chemistry", Sixth Edition, Pearson Education Ltd., New Delhi, 2011.
23. Ahluvalia, V.K., "Chemistry of Natural Products", First Edition, Vishal Publishing Co, Jalandhar, 2008.
24. Finar, I.L., "Organic Chemistry", Vol. II, Sixth Edition, Pearson Education Pvt. Ltd., Singapore, 2006.
25. Carrutherus, W., "Some Modern Methods in Organic Synthesis", Third Edition, Cambridge University Press, New York, 1997.
26. Ireland, R.E., "Foundation of Modern Organic Chemistry Series- Organic Synthesis", First Edition, Prentice – Hall of India Pvt. Ltd., New Delhi, 1975.
27. Mackie, R.K., Smith, M.M., and Aitken, R.A., "Guide Book to Organic Synthesis" Second Edition, Longman Scientific and Technical, Singapore, 1990.
28. Bruckner, R., "Advanced Organic Chemistry – Reaction Mechanism", First Edition, Elsevier India Pvt. Ltd., New Delhi, 2005.
29. Principles of Organic Synthesis, R. Norman and J. M. Coxon, Blackie Academic &Professional, 1988.
30. Mukherji, S.M., and Singh, S. P., Organic Reaction Mechanism by MacMillan India Ltd.

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : M.Sc., Chemistry **COURSE CODE : 21P1CMC1**

COURSE TITLE : Organic Chemistry-I **QN.NO : 12701**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives: *Theobjectiveofthiscourseistomakethestudent*

(i) To expand the knowledge of basic concepts in organic chemistry

(ii) To know and prove the mechanism for given organic reaction through various techniques and to examine the intermediates involved in the given conversion

(iii) To explore the knowledge of aromatic electrophilic substitution reactions

(iv) To gain the knowledge of nucleophilic substitution in aliphatic and aromatic systems

(v) To apply knowledge in synthesizing molecules using various substitution reactions.

Unit	Description	Hours	K-Level	CLO
I	**NATURE OF BONDING AND AROMATICITY** *Nature of bonding*: Shapes of simple organic molecules - bond angle, bond length, bond energies, electronegativity, dipole moment in organic molecules – ElectronicEffects: hyperconjucative, inductive and field effects and their influence - rules of resonance – tautomerism - steric effects – Hard and soft acids and bases. *Aromaticity*: Huckel's theory of aromaticity: three-, four-, five-, six-, seven-, and eight-membered rings – other systems with aromatic sextet - concept of homo-aromaticity and anti-aromaticity. *Bonding weaker than covalent*: Addition compounds – Electron donor-acceptor (EDA) complexes – Crown ether complexes – inclusion compounds – Cyclodextrins – Catenanes and Rotaxanes. Self-study: Hydrogen bonding: Inter- and intra- molecular – study of fullerenes.	15	Up to K2	CLO-1
II	**REACTION MECHANISM** Types of reaction and mechanism – Thermodynamic and kinetic requirements of reaction – Kinetic and thermodynamic control – Hammond postulate – Methods of determining mechanisms: Identification of products, determination of the presence of intermediate, study of catalysis, isotopic labelling, kinetic and stereochemical evidence, isotope effects. Linear Free energy Relationships: First Hammett plots - Hammett equation – physical significance of reaction and substituent constants – uses of Hammett plots - Taft equation – simple problems. Organic reactive intermediates: Generation, stability, structure and reactivity of carbocations, carbanions and free radicals. Self-study: Carbenes and nitrenes.	15	Up to K4	CLO-2
III	**AROMATIC ELECTROPHILIC SUBSTITUTION REACTIONS** Arenium ion mechanism – σ and π complex - Mechanism of nitration, sulfonation, Friedel Crafts alkylation, acylation and diazo coupling reactions. Orientation and reactivity in mono substituted benzene ring and benzene ring with more than one substituent – *ortho*/*para* ratio – *ipso* substitutions – Quantitative treatment – Electrophilic substitution of other aromatic species: Naphthalene, Pyridine, Pyrrole, Indole, Quinoline. Study of following reactions: Bischler-Napieralski, Pictet-Spengler, Scholl, Vilsmeier, Gattermann, Reimer-Tiemann, Kolbe-Schmitt, Mannich, Jacobsen and Haworth reactions.	15	Up to K3	CLO-3
IV	**ALIPHATIC NUCLEOPHILIC SUBSTITUTION REACTIONS** Mechanism of nucleophilic substitution reaction: S_N^1 and S_N^2 mechanisms. Stereochemistry of substitution reactions: Steric orientation in S_N^1 and S_N^2 – Neighbouring group participation: NGP by σ and π bonds – Role of following groups in NGP: C=C, cyclopropyl, aromatic rings, C-C, Hydrogen - S_N^1mechanism – Factors affecting reactivity: structure of alkyl group, nature of solvent, nature of leaving group, nature of nucleophilic reagent – Phase transfer catalysts in nucleophilic substitution reactions.	15	Up to K4	CLO-4

V	**AROMATIC NUCLEOPHILIC SUBSTITUTION REACTIONS** $S_NAr$mechanism in aryl halides by Meisenheimer complex - S_N1, $S_{RN}1$ and benzyne mechanism – Reactivity: The effect of substrate structure, leaving group and attacking nucleophile - Ambident nucleophiles and ambident substrates – Study of following name reactions and rearranements: Chichibabin, Schiemann, Meerweinarylation, Gomberg, Bamberger, Heck, Ullmann, Suzuki coupling, Stephens-Castro coupling, Von Richter, Sommelet Hauser and Smiles.	15	Up to K4	CLO-5

Books for study:

1. Clayden, J., Greeves, N. and Warren, S. "Organic Chemistry" Second Edition, Oxford University Press, New York, 2012.
2. Smith, M. B. March, J. "March's Advanced Organic Chemistry: Reactions, mechanisms and Structure" Sixth Edition, Wiley, 2007.
3. Skyes, P., "A Guide Book to Mechanism in Organic Chemistry" Sixth Edition, John Wiley & Sons, Inc. New York, 2011.

Books for reference:

1. Smith, M. B., "Organic Synthesis" Fourth Edition, Elsevier Inc., 2016.
2. Mukherji, S.M., and Singh, S. P., "Reaction Mechanism in Organic Chemistry" Revised edition, Trinity press, 2010.
3. Norman, R. O. C. and Coxon, J. M. "Principles of Organic Synthesis" Third edition, Nelson Thrones, United Kingdom, 2003.
4. Carey, F. A. and Sundberg, R. J. "Advanced Organic Chemistry-Part A: Structure and mechanisms" Fifth edition, Springer, 2007.
5. Carey, F. A. "Organic Chemistry" Fourth edition, Mc Graw Hill, 2000. Mukherji, S.M., and Singh, S. P., "Reaction Mechanism in Organic Chemistry" Third edition, MacMillan India Ltd, 2006.

Web resources:

1. https://onlinecourses.nptel.ac.in/noc21_cy07/preview
2. https://onlinecourses.swayam2.ac.in/cec20_ma20/preview
3. https://www.ntnu.edu/studies/mschem/organic-chemistry
4. https://www.youtube.com/watch?v=SAmLVOKIw28

Rationale for Nature of the course

This course will enable the students to comprehend the basic concepts of organic chemistry, structure of organic molecules, understand the reaction mechanism & the ways to prove it, electrophilic and nucleophilic substitution reactions in both aliphatic and aromatic substrates.

Activities having direct bearing on Skill development/ Employability/Entrepreneurship

The basic knowledge, concepts of reaction mechanism and study of various substitution reactions will help the students to write mechanism for a given conversion and to identify the intermediates involved. They can introduce a new functional group theoretically on the aliphatic and aromatic substrates by applying the techniques of electrophilic and nucleophilic reactions.

Pedagogy:

- Chalk-Talk Class room Activities
- Seminar
- Assignment and Quiz through ICT

Lesson plan:

Unit	Topics	Hours	Mode
I	*Nature of bonding*: Shapes of simple organic molecules - bond angle, bond length, bond energies, electronegativity, dipole moment in organic molecules	3	PPT, Chalk and talk, Group discussion
	Electronic Effects: hyperconjucative, inductive and field effects and their influence - rules of resonance – tautomerism - steric effects	3	
	Hard and soft acids and bases.	1	
	Aromaticity: Huckel's theory of aromaticity: three-, four-, five-, six-, seven-, and eight-membered rings – other systems with aromatic sextet	3	
	Concept of homo-aromaticity and anti-aromaticity.	1	
	Bonding weaker than covalent: Addition compounds – Electron donor-acceptor (EDA) complexes	2	
	Crown ether complexes – inclusion compounds – Cyclodextrins – Catenanes and Rotaxanes.	2	

II	Types of reaction and mechanism – Thermodynamic and kinetic requirements of reaction – Kinetic and thermodynamic control –	4	PPT, Chalk and talk, Assignment
	Methods of determining mechanisms: Identification of products, determination of the presence of intermediate, study of catalysis, isotopic labelling, kinetic and stereochemical evidence, isotope effects.	3	
	Linear Free energy Relationships: First Hammett plots - Hammett equation – physical significance of reaction and substituent constants – uses of Hammett plots - Taft equation – simple problems.	4	
	Organic reactive intermediates: Generation, stability, structure and reactivity of carbocations, carbanions and free radicals.	4	
III	Arenium ion mechanism – σ and π complex	1	PPT, Chalk and talk, Assignment
	Mechanism of nitration, sulfonation, Friedel Crafts alkylation, acylation and diazo coupling reactions.	3	
	Orientation and reactivity in mono substituted benzene ring and benzene ring with more than one substituent	3	
	ortho/*para* ratio – *ipso* substitutions – Quantitative treatment	2	
	Electrophilic substitution of other aromatic species: Naphthalene, Pyridine, Pyrrole, Indole, Quinoline.	3	
	Study of following reactions: Bischler-Napieralski, Pictet-Spengler, Scholl, Vilsmeier, Gattermann, Reimer-Tiemann, Kolbe-Schmitt,	3	
IV	Mechanism of nucleophilic substitution reaction: S_N^1 and S_N^2	3	PPT, Chalk and talk, Group discussion
	Stereochemistry of substitution reactions: Steric orientation in S_N^1 and S_N^2	2	
	Neighbouring group participation: NGP by σ and π bonds – Role of following groups in NGP: C=C, cyclopropyl, aromatic rings, C-C,	4	
	S_N^1mechanism – Factors affecting reactivity: structure of alkyl group, nature of solvent, nature of leaving group, nature of nucleophilic reagent	4	
	Phase transfer catalysts in nucleophilic substitution reactions.	2	
V	S_NArmechanism in aryl halides by Meisenheimer complex	2	PPT, Chalk and talk, Group discussion
	S_N^1, S_{RN}1 and benzyne mechanism	3	
	Reactivity: The effect of substrate structure, leaving group and attacking	3	
	Ambident nucleophiles and ambident substrates	1	
	Study of following name reactions and rearranements: Chichibabin, Schiemann, Meerweinarylation, Gomberg, Bamberger, Heck, Ullmann	3	
	Suzuki coupling, Stephens-Castro coupling, Von Richter, Sommelet Hauser and Smiles.	3	

Course learning outcome:

After successful completion of this course, the student will be able to

CLOs	CLO statement	Knowledge level
CLO 1	Understand the concept of aromaticity and to know the nature of bond, electronic effects and other properties of molecules.	Up to K2
CLO 2	Recognise the type of mechanism & intermediates involved in the given organic reaction and to prove mechanism for the reaction.	Up to K4
CLO 3	Identify the ways to modify aromatic compounds *via* electrophilic substitution reactions.	Up to K3
CLO 4	Analyse chemical transformations based on aliphatic nucleophilic substitution reaction	Up to K4
CLO 5	Organize the techniques of aromatic nucleophilic substitution reactions for synthesizing/transforming molecules	Up to K4

Mapping of CLOs with PLOs

#	PLO–1	PLO–2	PLO–3	PLO–4	PLO–5
CLO–1	2		2		
CLO–2	2		2		
CLO–3	2		2	2	
CLO–4	2		2	2	
CLO–5	2		2	2	

Advance application– 3; Intermediate level–2; Basic level–1

Components of Formative Assessment	Marks	K level
Internal Test	**10**	As per below table
Assignment	**5**	K4
Quiz	**5**	K4
Seminar	**5**	K4
Total	**25**	

Learning Outcome Based Education (LOBE) & Assessment
Formative Examinations I & II – Blue Print
Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

Units	CLOs	K- Level	Section A		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K Level		
1	CLO x	Up to K3	2	K2,K3	2 (K3&K3)	2(K2/K3)
2	CLO y	Up to K4	3	K2, K2, K3	2 (K4&K4)	1(K3/K4)
No. of Questions to be asked			5		4	3
No. of Questions to be answered			5		2	2
Marks for each question			2		5	10
Total Marks for each section			10		10	20

K1- Remembering and recalling facts with specific answers
K2- Basic understanding of facts and stating main ideas with general answers
K3- Application oriented- Solving Problems
K4- Examining, analyzing, presentation and make inferences with evidences

Learning Outcome Based Education (LOBE) & Assessment
Summative Examination – Blue Print
Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K2	2	K1 & K1	1	K1	2 (K1& K1)	1(K2)
2	CLO 2	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
3	CLO 3	Up to K3	2	K2 & K3	1	K1	2 (K2& K2)	1(K3)
4	CLO 4	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
5	CLO 5	Up to K4	2	K2 & K3	1	K3	2 (K3 & K3)	1(K3)
No. of Questions to be asked			**10**		**5**		**10**	**5**
No. of Questions to be answered			**10**		**5**		**5**	**3**
Marks for each question			**1**		**2**		**5**	**10**
Total Marks for each section			**10**		**10**		**25**	**30**

K1- Remembering and recalling facts with specific answers
K2- Basic understanding of facts and stating main ideas with general answers
K3- Application oriented- Solving Problems
K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A& B (No Choice)	Section C (Either / or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	6	10	-	16	13.3	35
K2	6	10	10	26	21.7	
K3	6	10	20	36	30	30
K4	2	20	20	42	35	35
Total marks	**20**	**50**	**50**	**120**	**100**	**100**

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : M.Sc., Chemistry **COURSE CODE : 21P1CMC2**

COURSE TITLE : Inorganic Chemistry-I **QN.NO : 12702**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives: *The objective of this course is to make the student*

(i) To understand the basic and advanced concepts in bonding and enable the students to identify the structure and bonding of simple molecules.

(ii) To study the various types of packing in solids

(iii) To provide knowledge of band theories and diffraction studies

(iv) To understand knowledge of the structure and bonding in boron compounds.

(v) *To enable students appreciate the structure of inorganic chain and cluster compounds.*

Unit	Course Contents	Hours	K-Level	CLO
I	**CHEMICAL BONDING** Valence bond approach to bonding-Hitler-London, Pauling and Slater refinements, concept of hybridization and structure of molecules, VSEPR theory shapes of molecules. M.O. approach to covalent bonding – symmetry and overlap of atomic orbitals – symmetry of molecular orbitals – Weak Chemical forces: van der Waals forces, Hydrogen bondingsigma and pi bonding – energy levels in homo and hetero nuclear diatomic systems – bond length, bond order and bond energy, Application to small molecules such as $BeCl_2$, BCl_3 and CCl_4, SF_4, etc, ionic character in a covalent bond - The concept of multicenter bonding. pseudo halogens: Structure and bonding in ClF_3, BrF_3, BrF_5 , IF_5, IF_7etc . Oxides and oxyacids of halogens, bonding in noble gas compounds – $XeCl_2$, XeF_4, $XeOF_4$, XeF_6.	15	Up to K3	CLO-1
II	**CHEMISTRY OF SOLID STATE I: STRUCTURE** Close packing of atoms and ions HCP and BCC types of packing voids, radius ratio – derivation – its influence on structures. Lattice energy – Born-Lande equation - Kapustinski equation, Madelung constant. Representative structures of AB and AB_2 types of compounds - rock salt, cesium chloride, wurtzite, zinc blende, rutile, fluorite, antifluorite, cadmium iodide and nickel arsenide. Structure of graphite and diamond. Spinels -normal and inverse types and perovskite structures.	15	Up to K4	CLO-2
III	**CHEMISTRY OF SOLID STATE II: DIFFRACTION METHODS** Band theory of solids- non-stoichiometry- point defects – linear defects-effects due to dislocations-electrical properties of solids-conductor, insulator, semiconductor-intrinsic-impurity semiconductors-optical properties-lasers and phosphors-elementary study of liquid crystals. Difference between point group and space group – screw axis – glide plane - symmetry elements –relationship between molecular symmetry and crystallographic symmetry – The Concept of reciprocal lattice – X-ray diffraction by single crystal – rotating crystal – powder diffraction. Neutron diffraction: Elementary treatment – comparison with X-ray diffraction. Electron diffraction- Basic principle. Crystal Growth methods: (hydrothermal andgel methods).	15	Up to K2	CLO-3
IV	**BORONCOMPOUNDS AND CLUSTERS** Chemistry of boron – boranes, higher boranes, borazines , boron nitrides, hydroborate ions – Preparation, properties and structure, STYX numbers, Wade's rules. Carboranes- Types such as nido-closo, arachno-preaprtion properties and Structure. Metallocarboranes-a general study. Metal clusters: Chemistry of low nuclearity metal clusters only, Structure of Re_2Cl_8; multiple metal-metal bonds.	15	Up to K4	CLO-4

V	**INORGANIC CHAIN AND CLUSTER COMPOUNDS** Types of inorganic polymers, comparison with organic polymers, silanes, higher silanes, multiple bonded systems, silicon nitrides, siloxanes. P-N compounds, cyclophosphazenes and S-N compounds – S_4N_4, (SN)x. Isopoly and heteropoly acids – Structure and bonding of 6- and 12 – isopoly and heteropoly anions. Structure of silicates - applications of Paulings rule of electrovalence - isomorphous replacements in silicates – ortho, meta and pyro silicates – one dimensional, two dimensional and three dimensional silicates.	15	Up to K4	CLO-5

Books for study:

1. R. D. Madan, Modern Inorganic Chemistry, 3rdedn, S. Chand & Company Ltd., Reprint2014.
2. J. E. Huheey, E. A. Keiter and R. L. Keiter, Inorganic chemistry-Principles on structure and reactivity, 4th Ed, Pearson- education, 2002.
3. F. A. Cotton and G. Wilkinson Advanced Inorganic Chemistry, Wiley Eastern, 1988.
4. K. F. Purcell and J. C. Kotz, Inorganic Chemistry, WB Sanders Co, USA, 1977.
5. Concise Inorganic Chemistry: Fifth Edition by J.D. Lee.

Books for Reference:

1. P.L. Soni, Text book of Inorganic Chemistry, 20thedn, Sultan Chand& Sons,2000.
2. Puri B.R.. Sharma L.R., Kalia K.K principles of Inorganic chemistry.35th edition, New edition: Shoban Lal Nagin Chand and co. 2013
3. R. B. Heslop and K. Jones, Inorganic Chemistry, Elsevier, 1976.
4. Sp. Banerjee, Advanced Inorganic Chemistry 2ndedn, Vol- and 2ArunabhaSen, Books and Allied (P) Ltd., Kolkata,2017.
5. Sathya Prakash, Tuli, Basu& Madan, Advanced Inorganic Chemistry. Vol. II , 17th edition, 1999.

Web references

1. https://resources.saylor.org/wwwresources/archived/site/wp-content/uploads/2011/06/VSEPR-Theory.pdf,http://www.idconline.com/technical_references/pdfs/chemical_engineering/Valence_bond_theory.pdf,https://chemistry.tcd.ie/assets/pdf/sf-chemistry/Molecular_Orbital_Theory.pdf,https://byjus.com/jee/hybridization/
2. https://ncert.nic.in/ncerts/l/lech101.pdf,https://www.vedantu.com/revision-notes/cbse-class-12-chemistry-notes-chapter-1-the-solid-state
3. http://web.iitd.ac.in/~elias/links/Elias%20lectures%20boron%20chemistry%202015%20final%2011th%20sept.pdf
4. http://ggu.ac.in/download/IT/Dr%20S%20S%20Thakur%20and%20Dr%20G%20K%20Patra%20M%20Sc%20IV%20Sem-Inorganic%20Chemistry-S-2-AR7148.pdf,
5. http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/chemistry/11.inorganic_chemistry-iii/29._metal-metal_bonds_and_their_evidences/et/9108_et_et_29.pdf
6. https://ipsonline.in/Files/2006/JanMar/ReviewArticle2.pdf
7. http://www.fhiberlin.mpg.de/acnew/department/pages/teaching/pages/teaching__wintersemester__2016_2017/thomas_lunkenbein__structural_chemistry_of_silicates__170127.pdf

Rationale for Nature of the course

The basic knowledge, concept of valence bond theory, VSEPR theory, Molecular orbital theory and study of bonding nature, structural elucidation and arrangement of atoms in a molecule with help of X-ray diffraction analysis in solid state chemistry, the boron compounds and cluster compounds will help the student to understand the structure, bonding and types of molecules.

Activities having direct bearing on Skill development/ Employability/Entrepreneurship

To comprehend the formation of new modules for the framing the structure of the molecule and their properties which ensure the knowledge of pathway of inorganic reactions.

Pedagogy

- Chalk-Talk class room Activities
- Group Discussion
- Seminar
- Quiz through ICT- Mode

Lesson plan:

Unit	Descriptions	Hours	Lecture Mode
I	**CHEMICAL BONDING**		
	V.B. approach to bonding-Hitler-London, Pauling and Slater refinements, Concept of hybridization and structure of molecules, VSEPR theory shapes of molecules	3	BB/PPT/ AnimatedVideos
	M.O. approach to covalent bonding – symmetry and overlap of atomic orbitals – symmetry of molecular orbitals, sigma and pi bonding, Weak Chemical forces: van der Waals forces, Hydrogen bonding.	3	BB/PPT/ AnimatedVideos
	sigma and pi bonding Energy levels in homo and hetero nuclear diatomic systems, bond length, bond order and bond energy	3	BB/PPT/ AnimatedVideos
	Application to small molecules such as $BeCl_2$, BCl_3 and CCl_4, SF_4, etc, Ionic character in a covalent bond, The concept of multicenter bonding	2	BB/PPT/ AnimatedVideos
	Pseudo halogens, Structure and bonding in ClF_3, BrF_3, BrF_5, IF_5, IF_7 etc.	2	BB/PPT/ AnimatedVideos
	Oxides and oxyacids of halogens, Bonding in Noble gas compounds – $XeCl_2$, XeF_4, $XeOF_4$, XeF_6	2	BB/PPT/ AnimatedVideos
II	**CHEMISTRY OF SOLID STATE I: STRUCTURE**		
	Close packing of atoms and ions HCP types of packing voids	3	BB/PPT/ AnimatedVideos
	Close packing of atoms and ions BCC types of packing voids, ratio – derivation – its influence on structures	3	BB/PPT/ AnimatedVideos
	Lattice energy – Born-Lande equation, Kapustinski equation, Madelung constant.	3	BB/PPT/ AnimatedVideos
	Representative structures of AB and AB_2 types of compounds - rock salt, cesium chloride, wurtzite	2	BB/PPT/ AnimatedVideos
	zinc blende, rutile, fluorite, antifluorite, cadmium iodide, Nickel arsenide.	2	BB/PPT/ AnimatedVideos
	Structure of graphite and diamond, Spinels -normal and inverse types and perovskite structures	2	BB/PPT/ AnimatedVideos
III	**CHEMISTRY OF SOLID STATE II: DIFFRACTION METHODS**		
	Band theory of solids- non-stoichiometry- point defects, linear defects- effects due to dislocations	3	BB/PPT/ AnimatedVideos
	electrical properties of solids-conductor, insulator, semiconductor-intrinsic-impurity semiconductors	3	BB/PPT/ AnimatedVideos
	optical properties-lasers and phosphors-elementary study of liquid crystals, Difference between point group and space group	3	BB/PPT/ AnimatedVideos
	screw axis and glide plane, symmetry elements–relationship between molecular symmetry and crystallographic symmetry	2	BB/PPT/ AnimatedVideos
	The Concept of reciprocal lattice, X-ray diffraction by single crystal – rotating crystal, powder diffraction	2	BB/PPT/ AnimatedVideos
	Neutron diffraction: Elementary treatment – comparison with X-ray diffraction, Electron diffraction- Basic principle. Crystal Growth methods: From melt and solution (hydrothermal, Gel methods).	2	BB/PPT/ AnimatedVideos

IV	**BORONCOMPOUNDS AND CLUSTERS**		
	Chemistry of boron – boranes, higher boranes, borazines, boron nitrides	3	BB/PPT/ AnimatedVideos
	hydroborate ions – Preparation, properties, hydroborate ions-structure	3	BB/PPT/ AnimatedVideos
	STYX numbers, Wade's rules, Carboranes, Carboranes types such as nido-closo- preaprtion properties and Structure	3	BB/PPT/ AnimatedVideos
	Carboranes types such as nido-closo- preaprtion properties and Structure	2	BB/PPT/ AnimatedVideos
	Carboranes types such as arachno- preaprtion properties and Structure,	2	BB/PPT/

	Metallocarboranes-a general study		AnimatedVideos
	Metal clusters: Chemistry of low nuclearity metal clusters only, Structure of Re_2Cl_8; multiple metal-metal bonds	2	BB/PPT/ AnimatedVideos
V	**INORGANIC CHAIN AND CLUSTER COMPOUNDS**		
	Types of inorganic polymers, Types of inorganic polymers-comparison with organic polymers	3	BB/PPT/ AnimatedVideos
	silanes, higher silanes, multiple bonded systems, silicon nitrides, siloxanes	3	BB/PPT/ AnimatedVideos
	P-N compounds, cyclophosphazenes, S-N compounds – S_4N_4, (SN)x	3	BB/PPT/ AnimatedVideos
	Isopoly acids – Structure and bonding of 6- and 12– isopoly anions, heteropoly acids – Structure and bonding of 6- and 12–heteropoly anions.	2	BB/PPT/ AnimatedVideos
	Structure of silicates, applications of Paulings rule of electrovalence	2	BB/PPT/ AnimatedVideos
	isomorphous replacements in silicates -ortho, meta and pyro silicates, one dimensional, two dimensional and three dimensional silicates.	2	BB/PPT/ AnimatedVideos

BB-Blockboard/ChalkandTalk

PPT-Powerpointpresentation

Course learning outcome:

After complete successful of this course, the student will be able

CLOs	CLO statement	Knowledge level
CLO1	To predict the structure and types of bond in inorganic molecules using VB and MO theories	Up to K3
CLO2	To illustrate the various types packing in solids	Up to K4
CLO3	To organize the knowledge on band theories of solids and diffraction studies	Up to K2
CLO4	To infer knowledge about structure and bonding in boron compounds	Up to K4
CLO5	To illustrate the structure of inorganic chain and cluster compounds	Up to K4

PLOand CLOMapping

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
CLO 1	1		3	1	2
CLO 2	1		3	1	2
CLO 3	1		3	1	2
CLO 4	1		3	1	2
CLO 5	1		3	1	2

3-Advance application; 2-Intermediate level; 1-Basic level

Internal Assessment : 25 Marks

External Assessment : 75 Marks

Total : 100 Marks

Components of FormativeAssessment	Marks	K level
Internal Test	**10**	As per below table
Assignment	**5**	K4
Quiz	**5**	K4
Seminar	**5**	K4
Total	**25**	

Learning Outcome Based Education (LOBE) & Assessment Formative – Blue Print

Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

Units	CLOs	K- Level	SectionA		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K Level		

1	CLO x	Up to K3	2	K2,K3	2 (K3&K3)	2(K2/K3)
2	CLO y	Up to K4	3	K2, K2, K3	2 (K4&K4)	1(K3/K4)
No. of Questions to be asked			5		4	3
No. of Questions to be answered			5		2	2
Marks for each question			2		5	10
Total Marks for each section			10		10	20

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Learning Outcome Based Education (LOBE) & Assessment

Summative Examination – Blue Print

Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K3	2	K2 & K3	1	K1	2 (K2& K2)	1(K3)
2	CLO 2	Up to K4	2	K2 & K3	1	K3	2 (K3 & K3)	1(K3)
3	CLO 3	Up to K2	2	K1 & K1	1	K1	2 (K1& K1)	1(K2)
4	CLO 4	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
5	CLO 5	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
No. of Questions to be asked			**10**		**5**		**10**	**5**
No. of Questions to be answered			**10**		**5**		**5**	**3**
Marks for each question			**1**		**2**		**5**	**10**
Total Marks for each section			**10**		**10**		**25**	**30**

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

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THE MADURA COLLEGE (Autonomous), MADURAI – 625 011

(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)

RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : M.Sc., Chemistry **COURSE CODE : 21P1CMC3**

COURSE TITLE : Physical Chemistry-I **QN.NO : 12703**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives: *The objective of this course is to make the student*

(i) To understand chemical kinetics and explore the reaction kinetics of fast reactions.

(ii) To infer knowledge on various aspects of Photochemistry, theories of reaction kinetics and mechanism involved in catalysis.

(iii) To gain on understanding of the Ionic activity, ionic interactions, Debye-Hückel-Bjerrum model, Debye-Hückel limiting law.

(iv) To study the Debye-Hückel theory of strong electrolytes.

(v) To classify the Electrical double layer, electrocapillary phenomena, surfactants, and to study the applications of Fuel Cells, Corrosion and its Protection.

Unit	Description	Hours	K-Level	CLO
I	**CHEMICAL KINETICS AND CATALYSIS** Absolute reaction rate theory -Thermodynamic terms-Significance of entropy Reactions in solution: factors determining reaction rates in solutions, effect of dielectric constant and ionic strength, - Bronsted – Bjerrum equation-Primary and Secondary salt effect, influence of solvent on reaction rates. Acid-base catalysis-Bronsted relations, catalytic coefficients and their determination. Enzyme catalysis and its mechanism, Michaelis-Menten equation, effect of pH and temperature on enzyme catalysis, Mechanism of enzyme inhibition kinetics of surface reactions- unimolecular reactions-Bimolecular reactions-Langmuir Hinshelwood and Elay-Rideal mechanism.	15	Up to K2	CLO-1
II	**CHEMICAL DYNAMICS** Potential energy surfaces-Dynamics of unimolecular reactions-Lindemann Hinshelwood, Rice-Ramsperger- Kassel(RRK) theory-Rice-Ramsperger-Kassel -Marcus (RRKM) theory. Study of fast reactions by stopped flow techniques- relaxation method, flash photolysis and the nuclear magnetic resonance method. Linear free energy relationship-Hammett equation, Taft equation-Separation of polar, resonance and steric effects.	15	Up to K3	CLO-2
III	**PHOTOCHEMISTRY** Jablonski diagram, Primary and Secondary Processes, quantum yield and its determination-chemical actinometer. Excimers and exciplexes-Kinetics of collisional quenching-Stern Volmer equations-Photosensitization,Chemiluminescence-Photosynthesis, solar energy conversions. Semiconductor photo catalysis, lasers. Radiation Chemistry-linear energy transfer, G-value, dosimeters, radiolysis of water, solvated electrons.	15	Up to K4	CLO-3
IV	**ELECTROCHEMISTRY – I** Deviation from ideal behaviour.ion-solvent and ion-ion interactions. Debye-Hückel-Bjerrum model, Ion association and triple ion formations-Expression for the mean activity coefficient. Debye-Hückel limiting law and its applications -Diverse ion effect. Van't Hoff factor and its relation	15	Up to K3	CLO-4

	to colligative properties. Debye-Hückel theory of strong electrolytes. Debye-Hückel length and potential around a central ion, its interpretation. Transport of ions in Solution: Electrolytic conduction-Debye - Hückel-Onsager treatment of strong electrolytes- ionic atmosphere- Anomalous conductance of non -aqueous electrolytes.			
V	**ELECTROCHEMISTRY- II** Electrical double layer - Electrocapillary phenomena - Surfactants - Lipmann's equation, Electrokinetic phenomena- Zeta potential and its applications -Structure of electrical double layer – Helmholtz-Perrin, Guoy-Chapmann and Stern models. Butler-Volmer equation for one electron transfer reaction - equilibrium and exchange current densities- and symmetry factor - transfer coefficient. Cyclic voltammetry and Stripping voltammetry - principle – instrumentation- Corrosion and passivation of metals - Pourbaix diagram - Evans diagram –Batteries and Fuel cells-Ion selective electrodes.	15	Up to K4	CLO-5

Books for study:

1. L. R. Puri, Y. R. Sharma and R. S. Pathania, Principles of Physical Chemistry 46th Ed, 2012.
2. K. J. Laidler, Chemical Kinetics, Harper and Row, New York, 1987.
3. Rohatgi-Mukherjee, K.K., "Fundamentals of Photochemistry", Second Edition, Wiley Eastern Ltd, New York, 2011.

Books for reference

1. R. G. Frost and Pearson, Kinetics and Mechanism, Wiley New York, 1961.
2. Philip H. Rieger, Electrochemistry ,2nd Edition, 2010.
3. A. W. Anderson, Physical Chemistry of Surfaces, Wiley - Interscience, Newyork, 1990.
4. Paula, Peter Atkins and Julio de, Elements of Physical chemistry, 5th Ed, Oxford U. P, 2012.
5. G. L. Agarwal, Basic Chemical Kinetics, Tata McGraw Hill, 1990.
6. N. J. Turro, Modern molecular photochemistry, Benjamin/Cummings, Menlo Park, California, 1978.

Web resources

1. https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Chemistry_The_Central_Science_(Brown_et_al.)/14%3A_Chemical_Kinetics/14.S%3A_Chemical_Kinetics_(Summary)
2. https://pubs.acs.org/doi/pdf/10.1021/cr60035a002
3. https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Spectroscopy/Electronic_Spectroscopy/Fluorescence_and_Phosphorescence
4. https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_(Analytical_Chemistry)/Electrochemistry

Rationale for Nature of the course

This course will enable the students to comprehend the concepts of photochemistry, theories of kinetics, understand the basic concepts and applications of electrochemistry.

Activities having direct bearing on Skill development/ Employability/Entrepreneurship

The basic knowledge, concepts of kinetics and electrochemistry will help the students to solve the problems related to kinetics and electrochemistry. The study of photochemistry and electrochemistry enable the students to do project related to solar cells.

Pedagogy

- Chalk-Talk class room activities
- Seminar
- Assignment and Quiz through ICT

Lesson Plan

Unit	Descriptions	Hours	Lecture Mode
I	**CHEMICAL KINETICS AND CATALYSIS**		
	Absolute reaction rate theory -Thermodynamic terms-Significance of entropy Reactions in solution:	3	Chalk and talk/PPT/ Group discussion
	factors determining reaction rates in solutions, effect of dielectric constant and ionic strength,	2	
	Bronsted –Bjerrum equation-Primary and Secondary salt effect, influence of solvent on reaction rates. Acid -base catalysis-Bronsted relations, catalytic coefficients and their determination	5	
	Enzyme catalysis and its mechanism, Michaelis-Menten equation, effect of pH and temperature on enzyme catalysis, Mechanism of enzyme inhibition kinetics of surface reactions	3	
	unimolecular reactions-Bimolecular reactions-Langmuir Hinshelwood and Elay-Rideal mechanism.	2	
II	**CHEMICAL DYNAMICS**		
	Potential energy surfaces-Dynamics of unimolecular reactions	3	Chalk and talk/PPT/ Group discussion
	Lindemann Hinshelwood, Rice-Ramsperger- Kassel (RRK) theory. Rice-Ramsperger-Kassel -Marsus (RRKM) theory	3	
	Study of fast reactions by stopped flow techniques- relexation method, flash photolysis and the nuclear magnetic resonance method.	4	
	Linear free energy relationship-Hammett equation, Taft equation	3	
	Separation of polar, resonance and steric effects.	2	
III	**PHOTOCHEMISTRY**		
	Jablonski diagram, Primary and Secondary Processes, quantum yield and its determination	3	Chalk and talk/PPT/ Animated videos/ Assignment
	chemicalactinometer. Excimers and exciplexes-Kinetics of collisional quenching-Stern Volmer equations	3	
	Photosensitization, Chemiluminescence-Photosynthesis, solar energy conversions	3	
	Semiconductor photo catalysis, lasers. Radiation Chemistry-linear energy transfer, G-value	3	
	Dosimeters, radiolysis of water, solvated electrons	3	
IV	**ELECTROCHEMISTRY i**		
	Deviation from ideal behaviour. ion-solvent and ion-ion interactions. Debye-Hückel-Bjerrum model, Ion association and triple ion	4	Chalk and talk/PPT/ Group discussion
	Debye-Hückel limiting law and its applications -Diverse ion effect. Van't Hoff factor and its relation to colligative properties	4	
	Debye-Hückel theory of strong electrolytes.Debye-Hückel length and potential around a central ion, its interpretation	4	
	Transport of ions in Solution: Electrolytic conduction- Debye - Hückel-Onsager treatment of strong electrolytes- ionic atmosphere- Anomalous	3	

V	**ELECTROCHEMISTRY II**		
	Electrical double layer - Electrocapillary phenomena - Surfactants - Lipmann's equation,	3	Chalk and talk/PPT/ Assignment
	Electrokinetic phenomena- Zeta potential and its applications -Structure of electrical double layer – Helmholtz-Perrin, Guoy-Chapmann and Stern models.	4	
	Butler-Volmer equation for one electron transfer reaction - equilibrium and exchange current densities- and symmetry factor - transfer coefficient.	4	
	Cyclic voltammetry and Stripping voltammetry - principle – instrumentation- Corrosion and passivation of metals - Pourbaix diagram - Evans diagram – Batteries and Fuel cells-Ion selective electrodes.	4	

Course Learning outcome:

After successful completion of this course, the student will be able to

CLOs	CLO statement	Knowledge level
CLO-1	Summarize the theories of kinetics, and mechanism of enzyme catalysis.	Up to K2
CLO-2	Develop equations based on the theories and mechanisms of kinetics.	Up to K3
CLO-3	Illustrate the various aspects of photochemistry, radiation chemistry and its applications	Up to K4
CLO-4	Make use of concepts of ionic interactions, theory of electrolytes, double layer models, Debye-Hückel limiting law.	Up to K3
CLO-5	Analyze the problem in the concept of electrical double layers, design of Batteries, Fuel cells and ion selective electrodes	Up to K4

Mapping of CLOs with PLOs

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
CLO1	3	1	3	3	2
CLO2	3	1	2	3	2
CLO3	3	1	1	3	2
CLO4	3	1	2	3	2
CLO5	3	1	3	3	2

Advance application-3; Intermediate level-2; Basic level-1

Components of Formative Assessment	Marks	K level
Internal Test	**10**	As per below table
Assignment	**5**	K4
Quiz	**5**	K4
Seminar	**5**	K4
Total	**25**	

Learning Outcome Based Education (LOBE) & Assessment
Formative Examination I & II – Blue Print
Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

Units	CLOs	K- Level	SectionA		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1	CLO x	Up to K3	2	K2,K3	2 (K3&K3)	2(K2/K3)
2	CLO y	Up to K4	3	K2, K2, K3	2 (K4&K4)	1(K3/K4)
No. of Questions to be asked			5		4	3
No. of Questions to be answered			5		2	2
Marks for each question			2		5	10
Total Marks for each section			10		10	20

K1- Remembering and recalling facts with specific answers
K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems
K4- Examining, analyzing, presentation and make inferences with evidences

Learning Outcome Based Education (LOBE) & Assessment
Summative Examination – Blue Print
Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K 2	2	K1 & K1	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	K 3	2	K2 & K3	1	K1	2 (K2&K2)	1(K3)
3	CLO 3	Up to K 4	2	K3 & K4	1	K2	2 (K4&K4)	1(K4)
4	CLO 4	Up to K 3	2	K2 & K3	1	K2	2 (K3&K3)	1(K3)
5	CLO 5	Up to K 4	2	K3 & K4	1	K3	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1- Remembering and recalling facts with specific answers
K2- Basic understanding of facts and stating main ideas with general answers
K3- Application oriented- Solving Problems
K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A& B (No Choice)	Section C (Either / or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	6	10	-	16	13.3	35
K2	6	10	10	26	21.7	
K3	6	10	20	36	30	30
K4	2	20	20	42	35	35
Total marks	**20**	**50**	**50**	**120**	**100**	**100**

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THE MADURA COLLEGE (Autonomous), MADURAI – 625 011

(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)

RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : M.Sc., Chemistry **COURSE CODE : 21P1CME1**

COURSE TITLE : Biomolecules and Separation Techniques **QN.NO : 12704**

TIME : 3 Hours **MAX.MARKS :75**

Objectives: *The objective of this course is to make the student*

(i) Tohaveaknowledgeaboutproteinmetallobiomoleculesandtheroleofmetalionsin biological process.

(ii) Tolearnaboutchemicaltoxicologyandusesofinorganiccompoundsastherapeutic agents.

(iii) Todiscussaboutpolymericbio-organicmoleculessuchascarbohydrates,proteinsand nucleicacids.

(iv) Todescribe aboutthestructure, stereochemistryandsynthesisofantibioticsand vitamins.

(v) Tolearn aboutvarioustypesofseparationtechniquesfororganicandbiomolecules.

Unit	Description	Hours	K-Level	CLO
I	**METALLOPROTEINS** **Ironcontainingproteins:**Metalloporphyrins-Haemoglobin and myoglobin–Structures and work functions– synthetic oxygen carriers– **Electron carrier proteins**-Cytochrome– structure andwork function.**Magnesiumcontaining proteins:** Chlorophyll–structure–photosyntheticsequence.**Copper containing proteins:** Classification–bluecopperproteins–structureofbluecopperelectron transferases–copper protein asoxidases–cytochromecoxidase–mechanisticstudies ofcytochromecoxidase	15	Up to K2	CLO-1
II	**METALLOENZYMES** **Metalloenzymes:**Carboxy peptidaseA–structure and function ;Carbonicanhydrase– inhibition and poisoning – **Corrin ring system** – Vitamin B12 (cyanocobalamin) and B12 coenzymes–Invivo and Invitro nitrogen fixation. **Essentials of trace elements and chemical toxicology:** Traceelementsinbiologicalsystem.Metaliontoxicity-classesoftoxicmetal compounds – detoxification. **Metalsinmedicine:**Anti-arthritis drugs– Au and Cuin rheumatoid arthritis – Pt, and metallocenesin anti-cancer drugs. **Transport and storage of metals:** Mechanism–Fe and Cu storage and transport –sodium and potassium ions pumping.	15	Up to K3	CLO-2
III	**PROTEINS,NUCLEICACIDSAND CARBOHYDRATES** **Proteins:** Aminoacids and Protein structure, Analysis of N-terminal and C-terminals in a polypeptide. Sanger method, Edman degradation and Enzymatic analysis. Primary, secondary and tertiary structure of proteins. **Nucleic acids and Carbohydrates:** Chemistry of nucleic acids, nucleosides and nucleotides–Structure RNA and DNA and their biologicalimportance.Pyranoseandfuranoseformsofaldohexoseand ketohexose–methods used for thedeterminationofringsize-conformationofaldohexopyranose–structureand synthesis of lactose and sucrose. Briefstudyofstarch andcellulose.	15	Up to K4	CLO-3

IV	**ANTIBIOTICS AND VITAMINS** **Antibiotics and vitamins:** A detailed study of structure, stereochemistry and synthesis of penicillin, cephalosporin. Chemistry and physiological action of ascorbic acid, thiamin, riboflavin and pyridoxine–Elementary aspect of vitamins A, E, K and B_{12}.	15	Up to K3	CLO-4
V	**SEPARATION TECHNIQUES** Basic aspects of thin-layer chromatography (TLC),column chromatography and flash vacuum column chromatography. Principles, theory, instrumentation and applications of Ion- exchange column Chromatography, Gel-permeation Chromatography, Gas chromatography and High Performance Liquid chromatography(HPLC)-Interpretation of chromatogram and separation of components from the mixture.	15	Up to K4	CLO-5

Books for study:

1. S. J. Lippard and J. M. Berg, Principles of Bioinorganic Chemistry, Panima Publishing Corporation, 1997.
2. David L. Nelson and Michael M. Cox, Leninger Principles of Biochemistry, WH Freeman, 2017.
3. D. A. Skoog and D. M. West, Fundamentals of Analytical Chemistry, Holt Rinehart and Winston Publications, 4th Ed, 1982.

Books for reference:

1. F. A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, Wiley Eastern, 5th Ed, 1998.
2. John McMurray, Organic Chemistry, International Edition, 8th Ed, 2017.
3. I. L. Finar, Organic Chemistry Vol 2, Stereochemistry and the Chemistry of Natural Product, Dorling Kindersley India (P) Ltd, 2009.
4. B. S. Furniss, A. J. Hannaford, P. W. G. Smith and A. R. Tatchell, Vogel's text book of Practical Organic Chemistry, Pearsons Education (Singapore) PTE Ltd, 3rd reprint, 2005.
5. Douglas A. Skoog, F. James Holler and Stanley R. Crouch, Principles of Instrumental Analysis, CENAGE Learning, 7th Ed, 2018.
6. Douglas A. Skoog, Donald M. West, F. James and Stanley R. Crouch, Fundamentals of Analytical Chemistry, 8th Ed, 2004.

Web resources

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4002152/
2. https://chem.libretexts.org/Courses/University_of_Arkansas_Little_Rock/CHEM_4320%2F%2F5320%3A_Biochemistry_1/04%3A_Overview_of_Hemoglobin_and_Myoglobin/4.2%3A_Oxygen__Transport__by__the_Proteins__Myoglobin_and__Hemoglobin
3. https://www.open.edu/openlearn/science-maths-technology/biology/nutrition-vitamins-and-minerals/content-section-1.
4. https://nptel.ac.in/courses/104/105/102105034/ (28 Videos)
5. https://www.vanderbilt.edu/AnS/physics/brau/H182/Fleming%20reading/ANTIBIOTICS%20LECTURE%20FOR%20WEB.pdf
6. https://nptel.ac.in/content/storage2/courses/126104004/LectureNotes/Week-4_02-Water%20soluble%20Vitamins%204.pdf

Rationale for Nature of the course

This course represents an attractive means of combining state-of-the-art transition metal catalysis with the benefits of natural enzymes, importance of biological macromolecules in the constituents of organisms and separation techniques for the purification of natural products.

Activities having direct bearing on Skill development/ Employability/Entrepreneurship

The basic concept of biomolecules helps the students for development of their skills in designing of Bio mimicry products and development of new designed Medicine (understanding biomolecules enables modulation of biology, as well as mimicking).

Pedagogy

- Chalk-Talk class room activities
- Group Discussion
- Seminar
- Quiz through ICT- Mode

LessonPlan

Unit	Topics	Hours	Mode
I	**UNIT-I METALLO PROTEINS**		
	Iron containing proteins: Metalloporphyrins-Haemoglobin and myoglobin – Structures and work functions	3	BB/PPT/ Animated Videos
	Synthetic oxygen carriers – Cytochrome – structure and work function.	3	
	Magnesium containing proteins Chlorophyll – structure – photosynthetic sequence.	3	
	Copper containing proteins: Classification –blue copper proteins – structure of blue copper electron transferases –	3	
	Copper protein as oxidases – Cytochrome c oxidase – mechanistic studies of cytochrome c oxidase	3	
	UNIT-IIMETALLOENZYMES		
II	**Metalloenzymes:**Carboxy peptidaseA–s tructure and function ;Carbonic anhydrase– inhibition and poisoning – Corrin ring system	2	BB/PPT/ Animated Videos
	Vitamin B12(cyanocobalamin) andB12coenzymes– InvivoandInvitronitrogen fixation.	3	
	Essentialsoftraceelementsandchemical toxicology: Traceelementsinbiologicalsystem.Metaliontoxicity-classesoftoxicmetal compounds – detoxification.	2	
	Metalsinmedicine: Anti-arthritis drugs– Au and Cuin rheumatoid arthritis –Pt, and metallocenesin anti-cancer drugs	3	
	Transportandstorageofmetals: Mechanism –Feand Custorageandtransport	3	
	Sodium and potassium ions pumping	2	
	UNIT-III:PROTEINS,NUCLEICACIDSAND CARBOHYDRATES		
III	Proteins: Aminoacid sand Protein structure, Analysis of N-terminal and C-terminals in a polypeptide	2	BB/PPT/ Animated Videos/ Assignment
	Sanger method, Edmandegradation and Enzymatic analysis. Primary, secondary and teritiary structure of proteins.	3	
	NucleicacidsandCarbohydrates: Chemistry ofnucleicacids,nucleosidesand nucleotides	2	
	StructureRNAandDNAandtheir biologicalimportance.	3	
	Pyranose and furanose forms of aldohexose and ketohexose–methods used for the determination of ring size	2	
	Conformation of aldohexopyranose – structure and synthesis of lactose and sucrose. A briefstudyofstarch andcellulose.	3	
	UNIT-IV:ANTIBIOTICS AND VITAMINS		
IV	Adetailedstudy ofstructure,stereochemistry andsynthesisofpenicillin,cephalosporin.	5	BB/PPT/ Animated Videos
	Chemistry andphysiologicalactionofascorbicacid, thiamin, riboflavin and pyridoxine	4	
	Elementaryaspectofvitamin A,E	3	

	Elementary aspect of vitamin K and B12	3	
	UNITV:SEPARATION TECHNIQUES		
V	Basic aspects of thin-layer chromatography (TLC),column chromatography and flash vacuum column chromatography.	4	BB/PPT/ Animated Videos
	Principles,theory,instrumentationandapplicationsofIon- exchangecolumn Chromatography	3	
	Principles,theory,instrumentationandapplicationsof,Gel-permeationChromatography,Gas chromatography and High Performance Liquidchromatography(HPLC)	4	
	Interpretation ofchromatogramandseparation ofcomponentsfrom themixture.	4	
	Total	**75**	

Course learning outcome:

After successful completion of this course, the student will be able

CLOs	**CLOstatement**	**Knowledge Level**
CLO1	To understand the Structures and work functions of Metalloproteins and apply the knowledge of work function on synthetic oxygen carries	Up to K2
CLO2	To illustrate the various functions of metalloenzymes and apply the knowledge on detoxification	Up to K3
CLO3	Tofocus on the components and approach to determine the structure of amino acids, proteins, nucleic acids and carbohydrate.	Up to K4
CLO4	Toidentify the method of synthesis and physiological action of antibioticsand vitamins.	Up to K3
CLO5	Toinspect the suitable techniques for the separation of organicaswell as bio molecules.	Up to K4

Mapping of CLOs with PLOs

#	PLO–1	PLO–2	PLO–3	PLO–4	PLO–5
CLO–1	2	2	3	1	1
CLO–2	2	2	3	1	1
CLO–3	2	2	3	1	1
CLO–4	2	2	3		1
CLO–5	2	2	3	1	1

Advance application– 3; Intermediate level–2; Basic level–1

Components of Formative Assessment	**Marks**	**K level**
Internal Test	**10**	As per below table
Assignment	**5**	K4
Quiz	**5**	K4
Seminar	**5**	K4

Total	25	

Learning Outcome Based Education (LOBE) & Assessment
Formative Examinations I & II – Blue Print
Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

Units	CLOs	K- Level	SectionA		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K Level		
1	CLO x	Up to K3	2	K2,K3	2 (K3&K3)	2(K2/K3)
2	CLO y	Up to K4	3	K2, K2, K3	2 (K4&K4)	1(K3/K4)
No. of Questions to be asked			5		4	3
No. of Questions to be answered			5		2	2
Marks for each question			2		5	10
Total Marks for each section			10		10	20

K1- Remembering and recalling facts with specific answers
K2- Basic understanding of facts and stating main ideas with general answers
K3- Application oriented- Solving Problems
K4- Examining, analyzing, presentation and make inferences with evidences

Learning Outcome Based Education (LOBE) & Assessment
Summative Examination – Blue Print
Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K 2	2	K1 & K1	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K 3	2	K2& K3	1	K2	2 (K3&K3)	1(K3)
3	CLO 3	Up to K 4	2	K3& K4	1	K2	2 (K4&K4)	1(K4)
4	CLO 4	K 3	2	K2& K3	1	K1	2 (K2&K2)	1(K3)
5	CLO 5	Up to K 4	2	K3& K4	1	K3	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1-Rememberingandrecallingfactswithspecificanswers
K2-Basicunderstandingoffactsandstatingmainideaswithgeneralanswers
K3-Applicationoriented-SolvingProblems
K4-Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A& B (No Choice)	Section C (Either / or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	6	10	-	16	13.3	35
K2	6	10	10	26	21.7	
K3	6	10	20	36	30	30
K4	2	20	20	42	35	35
Total marks	**20**	**50**	**50**	**120**	**100**	**100**

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THE MADURA COLLEGE (Autonomous), MADURAI – 625 011

(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)

RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : M.Sc., Chemistry **COURSE CODE : 21P1CNM1**

COURSE TITLE : Applied Chemistry **QN.NO : 12707**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives: *The objective of this course is to make the student*

(i) To study about the usage of safety matches and its preparation, calculation of oxidation numbers.

(ii) To know about corrosion, rusting of iron, and manufacturing of paints.

(iii) To study the preparation and importance of Antipyretics, Analgesics and Antiseptics.

(iv) To study about different types of polymers like PVC, Nylon and polyethylene.

(v) To know about the hardness of water disadvantages and removal of hardness using various methods.

Unit	Description	Hours	K-level	CLO
I	**Small Scale Units** Preparation and importance of safety matches – Agarbattis - Naphthalene balls - Shoe polish – Chalk piece – tooth paste – phenoyl – ink- camphor tablets.	6	Up to K2	CLO-1
II	**Corrosion** Corrosion – definition – Types of corrosion- rusting of iron – preventive methods: Cathodic and Anodic protection-corrosion inhibitors-Electro plating method – Paints – varnishes.	6	Up to K2	CLO-2
III	**Pharmaceutical Chemistry** Classification of drugs - Application of the following drugs: Antipyretics: Salicin, Phenacetin, Aspirin, Tylenol. Analgesics: Novalgin, Chloroform, Diethyl ether. Antiseptics: Chloramine-T, Dettol, Thymol, Boric acid, Potassium permanganate. (structure and synthesis not necessary) Chemotherapy:definition – classification ofchemotherapeutic agents(names and uses only).	6	Up to K2	CLO-3
IV	**Polymers** Monomer – polymer – definition – classification – differences between thermoplastics and thermosetting polymers – Polymerization: definition, types and examples – examples for addition, condensation and co-ordination polymers – Properties and uses of following: Polyethylene, Polyvinyl chloride (PVC), Polytetrafluoroethylene (PTFE), and Nylon-66	6	Up to K2	CLO-4
V	**Water Treatment** Water: Source of water – characteristics of water – Hardness of water – Types – Temporary hardness – permanent hardness – disadvantages of hard water – Removal of hardness – Reverse osmosis – zeolite process.	6	Up to K2	CLO-5

Books for study:

1. Ghosh, J. Fundamental concepts of Applied Chemistry, 1st Edition, S. Chand Limited, Nagpur, 2006.
2. Jain, P. C., Jain, M. Enginering chemistry, 15th edition., 1998, Dhanpat Rai Publishing Company.
3. Kapur, K. Text Book of Applied Chemistry, 1st edition, New Delhi, H.Tata publications, 1994.

Books for Reference:

1. Sharma, B. K., Industrial chemistry, 11th EditionGoelPuplisihing House, 1994.
2. Charrabarthy B.N., Industrial Chemistry, 1stEdition, Oxford and IBH Publishing co. Pvt. Ltd. 1981.
3. A, L. Gupta, Polymer Chemistry, PragatiPrakshan Publications, Meerut, Revised edition, 2010.
4. Jayashree Gosh, A textbook of Pharmaceutical Chemistry, S. Chand Publications, 1st edition, 2017

Web resources

1. https://www.entrepreneurindia.co/book-details/294/surfactants-disinfectants-cleaners-toiletries-personal-care-products-manufacturing-and-formulations
2. https://www.twi-global.com/technical-knowledge/faqs/what-is-corrosion
3. https://accessmedicine.mhmedical.com/content.aspx?sectionid=102161048&bookid=1613
4. https://www.sciencenewsforstudents.org/article/explainer-what-are-polymers
5. https://www.hunterwater.com.au

Rationale for Nature of the course

This course will enable the students to enrich the understanding of preparation of various compounds likeAgarbattis, Naphthalene balls, Shoe polish etc., fundamental principles ofcorrosion and mechanism of rust formation, Antipyretics and analgesics, Antiseptics, polymers and its types. Students know about the hardness of water and how the hardness will be removed.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

The basic study of preparation of various compounds likeAgarbattis, Naphthalene balls, Shoe polish etc., the concepts of corrosion and its mechanism were explained by doing chart work. The Removal of hardness, Reverse osmosis, zeolite process was explained by industrial visit.

Pedagogy

- Chalk-Talk Class room Activities
- group Discussion
- seminar
- Quiz through ICT- Mode

Lesson Plan

Unit	Descriptions	Hours	Lecture Mode
I	**Small Scale Units**		
	Introduction and manufacturing of Safety matches – Agarbattis.	2	BB/PPT
	Manufacturing of Naphthalene balls - Shoe polish – Chalk piece.	2	BB/PPT/
	Preparation and importance of tooth paste – phenoyl – ink- camphor tablets.	2	BB/PPT
II	**Corrosion**		
	Corrosion – definition - Types of corrosion- rusting of iron.	2	BB/PPT
	Preventive methods: Cathodic and Anodic protection-corrosion inhibitors.	2	BB/PPT
	Electro plating method – Paints – varnishes.	2	BB/PPT
III	**Pharmaceutical Chemistry**		
	Classification of drugs- Application of the following drugs: Antipyretics: Salicin, Phenacetin, Aspirin, Tylenol.	2	BB/PPT
	Analgesics: Novalgin, Chloroform, Diethyl ether. Antiseptics: Chloramine-T, Dettol, Thymol.	2	BB

	Boric acid, Potassium permanganate.(structure and synthesis not necessary) Chemotherapy:definition – classification ofchemotherapeutic agents(names and uses only).	2	BB/PPT
IV	**Polymers**		
	Monomer – polymer – definition – classification – differences between thermoplastics and thermosetting polymers	2	BB/PPT
	Polymerization: definition, types and examples – examples for addition, condensation and co-ordination polymers	2	BB/PPT
	Properties and uses of following: Polyethylene, Polyvinyl chloride (PVC), Polytetrafluoroethylene (PTFE), and Nylon-66	2	BB
V	**Water Treatment**		
	Water: Source of water – characteristics of water – Hardness of water	2	BB/PPT
	Types – Temporary hardness – permanent hardness – disadvantages of hard water	2	BB/PPT
	Removal of hardness – Reverse osmosis – zeolite process	2	BB/PPT
	Total Hours	30	

Course outcome: After complete successful of this course, the student will be able to

CLOs	CLO statement	Knowledge level
CLO1	Elaborate the preparation and importance of household products.	Up to K2
CLO2	Explain the corrosion and its preventive methods.	Up to K2
CLO3	Outline the importance of Antipyretics, Analgesics and Antiseptics.	Up to K2
CLO4	Illustratethe different types of polymers and polymerisation.	Up to K2
CLO5	Know about the hardness of water and its types, various removable methods.	Up to K2

PLO and CLO Mapping

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
CLO1	1	1	1	2	2
CLO2	1	2	1	3	2
CLO3	2	3	2	3	2
CLO4	1	2	1	1	1
CLO5	1	3	1	1	2

3-Advance application; 2-Intermediate level; 1-Basic level

Components of Formative Assessment	Marks	K level
Internal Test	**10**	As per below table
Assignment	**5**	K2
Quiz	**5**	K2
Seminar	**5**	K2
Total	**25**	

Learning Outcome Based Education (LOBE) & Assessment
Formative Examination-I & II -Blue Print
Articulation Mapping - K Levels with Course Outcomes (CLOs)

S. No.	CLOs	K- Level	Section A	Section B	
			Short Answers		

			No. of Questions	K- Level	(Either/or Choice)	Section C (Open
1	CLO x	Up to K 2	2	K1, K1	2 (K2 &K2)	1(K1)
2	CLO y	Up to K 2	3	K1, K1,K1	2 (K2 &K2)	2(K1, K1)
No. of Questions to be asked			5		4	3
No. of Questions to be answered			5		2	2
Marks for each question			2		5	10
Total Marks for each section			10		10	20

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers.

Learning Outcome Based Education (LOBE) & Assessment Summative Examination – Blue Print Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

Units	**CLOs**	**K- Level**	**Section A**		**Section B**		**Section C (open Choice)**
			Short answers		**(Either/or Choice)**		
			No. of Questions	**K- Level**	**No. of Questions**	**K- Level**	
1	CLO 1	Up to K 2	1	K1	1	2 (K2&K2)	K1
2	CLO 2	Up to K 2	1	K1	1	2 (K2&K2)	K1
3	CLO 3	Up to K 2	1	K1	1	2 (K2&K2)	K1
4	CLO 4	Up to K 2	1	K1	1	2 (K2&K2)	K1
5	CLO 5	Up to K 2	1	K1	1	2 (K2&K2)	K1
No. of Questions to be asked			5		5		5
No. of Questions to be answered			5		5		3
Marks for each question			2		7		10
Total Marks for each section			10		35		30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers.

Distribution of Section-wise marks with K-levels

K Levels	**Section A (No Choice)**	**Section B (Either / or)**	**Section C (Open Choice)**	**Total Marks**	**% of Marks without choice**	**Consolidated**
K1	10		50	60	46	46
K2	-	70		70	54	54
Total marks	10	70	50	130	100	100

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