PART-2

Third Semester (CBCS)

Course Code	Course Type	Course (Paper/Subjects)	Credits	Contact Hours Per WeeK			EoSE Duration (Hrs.)		Marks	
				L	T	P	Thy	P	SEE	IA
MSC 301	CCC	CATALYSIS, SOLID STATE & SURFACE CHEMISTRY	6	4	3	00	3	0	70	30
MSC 302	CCC	REAGENTS & ORGANIC SYNTHESIS	6	4	3	00	3	0	70	30
MSC 303	CCC	ANALYTICAL CHEMISTRY	6	4	3	00	3	0	70	30
MSC 304	ECC	ELECTIVE COURSE	6	4	3	00	3	0	70	30
MSC 304A	ECC	ORGANOMETALLIC CHEMISTRY AND INORGANIC POLYMERS								
MSC 304B	ECC	CHEMISTRY OF NATURAL PRODUCTS								
MSC 304C	ECC	SUPRAMOLECULAR CHEMISTRY								
MSC 304D	ECC	CHEMISTRY OF BIOMOLECULES								

MSC 305	CCC	LAB COURSE- 1	6	0	0	09	0		100
MSC 306	CCC	LAB COURSE- II	6	0	0	09	0		100
MINIMUM CREDITS IN INDIVIDUAL SUBJECT IS 6 AND IN COMPLETE SEMESTER IT WOULD BE 36			Total Credit= 36						

M.Sc. CHEMISTRY THIRD SEMESTER

COURSE CODE: MSC 303	**COURSE TYPE: CCC**
COURSE TITLE: **CATALYSIS, SOLID STATE AND SURFACE CHEMISTRY**	
CREDIT: **THEORY: 6** **PRACTICAL:**	**HOURS:** **THEORY: 90** **PRACTICAL: 00**
MARKS: **THEORY: 70+30** **PRACTICAL:**	**MARKS** **THEORY:** **PRACTICAL:**

OBJECTIVE: The students will learn about general concept of acids, bases, electrophiles, nucleophiles and catalysis, concept of micelles, solid state chemistry and macromolecules.

UNIT-1 20 Hours

Equilibrium and Non- equilibrium Thermodynamics:

Properties of non-ideal solutions, excess functions, Nernst heat theorem, third law of thermodynamics, variation of entropy with temperature, determination of absolute entropy of liquids and gases. Entropy production in irreversible processes, fluxes and forces, coupled flows, linear phenomenological relations, Onsager's reciprocity relations, thermodynamic theory of membrane permeability, reverse osmosis.

UNIT-2 18 Hours

ACIDS, BASES, ELECTROPHILES, NUCLEOPHILES AND CATALYSIS :

Acid-base dissociation, Electronic and structural effects, acidity and basicity. Acidity function and their applications. Hard and soft acids and bases. Nucleophilicity scales. Nucleofugacity. The alpha effect. Ambivalent Nucleophilies. Acid base catalysis-specific and general catalysis. Bronsted catalysis, Enzyme Catalysis.

UNIT-3 18 Hours

MICELLES AND ADSORPTION:

Micelles: Classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of Surfactants. Thermodynamics of micellization - phase separation and mass action models. Reverse micells, micro-emulsion. Micellar Catalysis, Surface tension capillary action, pressure difference across curved surface (Laplace equation), vapour pressure of droplets (Kelvin equation), Gibbs adsorption isotherm.

UNIT-4 16 Hours

SOLID STATE CHEMISTRY - I:

Crystal defects and Non-stoichiometry - Perfect and imperfect crystals, intrinsic and extrinsic defects - point defect, line and plane defects, vacancies - Schotty defects and Frankel defects. Thermodynamics of Schotty and Frenkel defect, formation of color centres, non stoichiometry and defects. Electronic properties and Band theory of semiconductors.

UNIT-5 18 Hours

MACROMOLECULES:

Polymer – Definition, types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of polymerization, mechanism of polymerization. Molecular mass, average molecular mass, molecular mass determination (Osmometry, Viscometry, diffusion and light scattering methods), Sedimentation, chain configuration of macromolecules, calculation of average dimensions of various chain structures.

SUGGESTED READING BOOKS

1. G.W. Castellan, "Physical Chemistry", Addison-Lesley Publishing Co.
2. E.A. Moelwyn Hughes, "Physical Chemistry", Pergamon Press.
3. Denbigh, "Chemical Equilibria", D. Van Nostrand.
4. J. Rose, "Dynamic Physical Chemistry" Sir Issac Pitman and Sons.
5. Solid state"Chemistry and its Applications, A.R. West, Plenum.
6. Principle of Solid State H.V. Kar, Wiley Eastern.
7. Solid State Chemists, D.K. Chakrabarty, New Age International (P)Ltd.
8. Micelles, Theoretical and Applied Aspects, V. Moral Plenum.
9. The Chemistry Mathematics Book, E. Steiner, Oxford University Press.
10. Mathematics for Chemistry, Doggett and Sutcliffe, Longman.
11. Mathematical Preparation for Physical Chemistry, F. Daniels, McGrawHill.
12. Chemical Mathematics, D.M. Hirst, Longman.
13. Applied Mathematics for Physical Chemistry, J.R. Barrante, Prentice Hall.
14. Basic Mathematics for Chemists, Tebbutt, Wiley.
15. Quantum Chemistry, Ira N. Levine, Prentice Hall.
16. Introduction to Quantum Chemistry, A.K. Chandra, Tata McGrawHill

M.Sc. CHEMISTRY THIRD SEMESTER

COURSE CODE: MSC 302	**COURSE TYPE: CCC**
COURSE TITLE: **REAGENTS AND ORGANIC SYNTHESIS**	
CREDIT: **THEORY: 6** **PRACTICAL:0**	**HOURS:** **THEORY: 90** **PRACTICAL: 00**
MARKS: **THEORY: 70+30** **PRACTICAL:**	**MARKS** **THEORY:** **PRACTICAL:**

OBJECTIVE: The students will learn about various OxidationandReduction methods along with the reagents, Reagents having the synthetic importance, Introduction to Retrosynthetic approach and Retrosynthetic analysis with Diels-Alder reaction, Michael addition and Robinson annellation, etc.

UNIT -1 20 Hours

Oxidation : (i) Oxidation with peracids: Oxidation of carbon-carbon double bonds, carbonyl compounds, allylic carbon-hydrogen bonds, (ii) Oxidation with selenium dioxide and Osmium tetraoxide, (iii) Oxidation with lead tetraacetate, mercuric acetate (iv) hypervalent iodine; Alcohol oxidation , Amino oxidation, Dehydrogenation.

UNIT -2 20 Hours

Reduction: Catalytic hydrogenation and hydrogenolysis of various functional groups by Pt2O, Pd/C, raney nickel, Homogeneous hydrogenation by transition metal complexes {Rh, Ru}, Metal hydrides {LiAlH4, alkoxyaluminate, DIBAL-H, NaBH4, $NaBH_3CN$, $LiBH_4$, Zn(BH4)2, NaBH4/CeCl3, alkoxy/alkyl borohydrides, super-hydride, selectrides, n-Bu3SnH}, dissolving metal {Li, Na in Liq. NH3, Zn/HCl or CH3COOH}, non-metallic reducing agent.

UNIT-3 18Hours

Reagents of Synthetic Importance: Principle, preparations, properties and applications of the following reagents in organic synthesis with Mechanistics details: Group – I & II metal organic compounds-Li, M, Hg, Cd, Zn &Ce compounds. Transition metals – Cu, Pd, Ni, Fe, Co, Rh, Cr & Ti compounds.

UNIT -4 16 Hours

Introduction to Retrosynthetic approach ,Umpolung, Functional group interconversion, one group disconnection approach.

UNIT -5 16 Hours

Two group C-C disconnections Diels-Alder reaction, 1, 3-difunctionalised compounds, α, β-unsaturated carbonyl compounds, control in carbonyl condensation, 1, 5-difunctionalised compounds. Michael addition and Robinson annelation, Retrosynthetic analysis.

RECOMENDE READINGS:

1. H.O. House, *Modern Synthetic Reactions*, 2nd Edition (1972), Benjamin/CummingsPublishing Company, California.

2. L.F. Fieser and M. Fieser, *Reagents for Organic Synthesis,* Vol. 1-16 (Vol. 1, 1967), Wiley-Interscience, New York.

3. M.B. Smith and J. March, *March's Advanced Organic Chemistry – Reactions, Mechanisms & Structure*, 5th ed. (2001), Wiley-Interscience, New York.

4. M. B. Smith, *Organic Synthesis,* McGraw Hill Inc., New York (1995).

5. J. Clayden, N. Greeves, S. Warren, and E. Wothers, *Organic Chemistry,* Oxford Univ. Press, Oxford (2001).

6.P. R. Jenkins, *Organometallic Reagents in Synthesis,* Oxford science Publ., Oxford (1992).

M.Sc. CHEMISTRY THIRD SEMESTER

COURSE CODE: MSC 303	**COURSE TYPE: CCC**
COURSE TITLE: **ANALYTICAL CHEMISTRY**	
CREDIT: **THEORY: 6** **PRACTICAL:**	**HOURS:** **THEORY: 90** **PRACTICAL: 00**
MARKS: **THEORY: 70+30** **PRACTICAL:**	**MARKS** **THEORY:** **PRACTICAL:**

OBJECTIVE: The main objective of this course is to acquire basic concepts, principles, various methods and techniques of modern analytical chemistry as well as to develop an understanding of the range and uses of analytical methods in chemistry. This course would empower students with an analytical mind set and the abilities to solve diverse analytical problems in an efficient way.

UNIT-1 20 Hours

Introduction:

Scope & objectives, Analytical chemistry and chemical analysis, Classification of analytical methods, Method selection, Sample processing, Steps in a quantitative analysis, Quantitative range, Data organisation, Analytical validations, Limit of detection.

UNIT-2 18 Hours

Analytical chemometrics:

Propagation of measurement uncertainties (inaccuracy and imprecision). Useful statistical test: test of significance, the F test, the student 't' test, the chi-test, the correlation coefficient, confidence limit of the mean, comparison of two standard values, comparison of standard deviation with average deviation, comparison of mean with true values, significant figures, regression analysis (least square method for linear plot), statistics of sampling and detection limit, factor analysis, resolution and pattern recognition.

UNIT-3 18 Hours

Polarography:

Origin of polargraphy, Current-voltage relationship, Theory of polarographic waves (DC and sampled DC (tast) polarograms), Instrumentation, Ilkovic equation, Qualitative and quantitative applications.

UNIT-4 16 Hours

Spectroscopic Techniques:

Theory, Instrumentation and applications of X-rays (emission, absorption, diffraction and fluorescence methods), Atomic absorption Spectroscopy, Atomic fluorescence spectrometry, Atomic emission spectrometry.

UNIT-5 18 Hours

Separation and analytical methods:

A. Separation Methods: Principle of chromatography, Classifications of chromatography, Techniques of planar and column chromatography, Gas chromatography, High-performance liquid chromatography

B. Thermal Analysis: Theory, methodology and applications of thermogravimetric analysis (TGA), Differential Thermal Analysis (DTA), and Differential scanning calorimetry (DSC). Principles, techniques and applications of thermometric titration methods.

SUGGESTED READING BOOKS

1. R. L. Pecsok, L. D. Shields, T. Cairns and L.C. Mc William, Modern Methods of Chemical Analysis, 2nd Edition (1976), John Wiley, New York.
2. G. D. Christian, Analytical Chemistry, 5th Edition (1994), John Wiley & Sons, New York.
3. D. A. Skoog, D.M. West, F.J. Holler, S.R. Crouch, Analytical Chemistry - An Introduction, 7 th Edition (2000), Saunders College Publishing, Philadelphia, London.
4. J. H. Kennedy, Analytical Chemistry: Principles, 2nd Edition (1990), Saunders Holt, London.
5. G.W. Ewing, Instrumental Methods of Chemical Analysis, 5th Edition (1978), McGraw Hill Books Co., New York.

M.Sc. CHEMISTRY THIRD SEMESTER

COURSE CODE: MSC 304A	**COURSE TYPE: ECC**
COURSE TITLE: **ORGANOMETALLIC CHEMISTRY AND INORGANIC POLYMERS**	
CREDIT: **THEORY: 6** **PRACTICAL:**	**HOURS:** **THEORY: 90** **PRACTICAL: 00**
MARKS: **THEORY: 70+30** **PRACTICAL:**	**MARKS** **THEORY:** **PRACTICAL:**

OBJECTIVE:

1. To develop the understanding of characteristics and synthesis of organometallic complexes with different types of ligands and their catalytic application in organic synthesis.
2. To introduce various types of inorganic polymers and their structural features

UNIT-1: Inorganic π-acid Ligands 20 Hours

Dioxygen and dinitrogen, nitrosyl, tertiary phosphines and arsines as ligands.

UNIT-2 : Complexes of s–donor ligands 18 Hours

Transition metal alkenyls, alkynyls, carbenes and carbynes.

UNIT-3 π-complexes of unsaturated molecules 20 Hours

Preparation, bonding and structure of alkene, alkyne, allyl, dienyl and trienyl complexes; reactions with special reference to organic synthesis

.

UNIT-4 Transition metal compounds in catalysis 18 Hours

Hydrogenation, hydroformylation and polymerization; Wacker Process. Basic Aspects of Organic Synthesis with Transition Metals. Coupling reactions: Heck reaction, Sonogashira coupling, Negishi coupling, Suzuki reaction and Stille cross coupling.

Transition metal Compounds with M-H bonds

Metal hydrides (classical and nonclassical). Agostic interaction. Application of NMR in studying hydrido complexes

UNIT-5 Inorganic Polymers 14 Hours

Classification, Types of Inorganic Polymerization, Comparison with organic polymers, Boron-oxygen and boron-nitrogen polymers, silicones, coordination polymers, sulphur-nitrogen, sulphur-nitrogen-fluorine compounds, - binary and multicomponent systems, haemolytic inorganic systems

RECOMENDE READINGS:

F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, 6th Ed. (1999) John Wiley & Sons, NY. 15

2. J.E. Huheey, Keiter and Keiter, Inorganic Chemistry,

3. R. H. Crabtree, The Organometallic Chemistry of Transition Metals, John Wiley.

4. Ch. Elschenbroich and A. Salzer, Organometallics, VCH.

5. J.P. Collman, L.S. Hegedus, J.R. Norton and R.G. Finke, Principles and Applications of Organotransition metal Chemistry, Univ. Sci. Books, Mill Valley. California.

M.Sc. CHEMISTRY THIRD SEMESTER

COURSE CODE: MSC 304B	**COURSE TYPE: ECC**

COURSE TITLE:

CHEMISTRY OF NATURAL PRODUCTS

CREDIT: **THEORY: 6** **PRACTICAL:0**	**HOURS:** **THEORY: 90** **PRACTICAL: 00**
MARKS: **THEORY: 70+30** **PRACTICAL:**	**MARKS** **THEORY:** **PRACTICAL:**

OBJECTIVE : To study in details about Occurrence, classification, nomenclature, isolation, structure elucidation and synthesis of different terpenoids, carotenoids, alkaloids, steroids, plant pigments, Prostaglandins and Thromboxanes.

UNIT-1 17 Hours

Terpenoids and Carotenoids: Classification, nomenclature, occurrence, isolation, general methods of structure determination of Citral, Geraniol, α- Terpeneol, Menthol, Farnesol, Zingiberene, Santonin, Phytol, Abietic acid and β – Carotene.

UNIT-2 20 Hours

Alkaloids: Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, degradation, classification based on Nitrogen heterocyclic ring, role of alkaloids in plant. Synthesis and biosynthesis of the following: Ephedrine, (+) - Conine, Nicotine, Atropine, Quinine and Morphine.

UNIT-3 17 Hours

Steroids: Isolation, structure determination and synthesis of Cholesterol, Bile acids, Androsterone, Testosterone, Esterone, Progestrone, Aldostrone and Biosythesis of cholesterol.

UNIT-4 19 Hours

Plant Pigments: Occurrence, nomenclature and general method of structure determination. Isolation and synthesis of Apigenin, Luteolin, Quercetin, Myrcetin, Quercetin-3-glucoside, Vitexin, Diadzine, Butein, Aureusin, Cyanidin, Hirsutidin.

UNIT-5 17 Hours

Prostaglandins and Thromboxanes : Introduction, nomenclature of prostaglandins and thromboxanes; approaches to prostaglandin synthesis; cyclohexane precurors (Woodward synthesis of PGF2a), bicycloheptane precursors (Corey's synthesis of prostaglandins E and F).

RECOMENDED READINGS:

1. Natural Products: Chemistry and Biological Significance, J. Mann, R.S. Davidson, J.B. Hobbs.
2. D.V. Banthrope and J.B. Harbrone, Longman, Essex., Organic Chemistry, Vol.2, I.L. Finar, ELBS.
3. Chemistry, Biologcal and Pharmacological properties of Medicinal Plants from the Americans, Ed. Kurt Hostettmann, M. P. Gupta and A. Marston, Harwood Academic Publishers.
4. Introductionto Flavonoids, B.A. Bhom, Harwood Academic Publishers.
5. New Trendsin Natural Product Chemistry, Att-ur-Rahman and M.I. Choudhary, Harwood, Academic Publishers.
6. Insecticides of Natural Origin, SukhDev, Harwood Academic Publishers.
7. Introduction to medicinal Chemistry, A Gringuage, Wiley-VCH.
8. Burger'sMedicinalChemistry-1(Chapter-9andCh-14), DrugEd. M.E. Discovery, Wolff, John Wiley.
9. The Science of Flavanoids, Erich Groteworld, Springer

M.Sc. CHEMISTRY THIRD SEMESTER

COURSE CODE: MSC 304C	**COURSE TYPE: ECC**
COURSE TITLE:	
SUPRA MOLECULAR CHEMISTRY	
CREDIT: **THEORY: 6** **PRACTICAL:0**	**HOURS:** **THEORY: 90** **PRACTICAL: 00**
MARKS: **THEORY: 70+30** **PRACTICAL:**	**MARKS** **THEORY:** **PRACTICAL:**

OBJECTIVE

1. Concepts of Supramolecular Chemistry, the chemistry beyond molecule.
2. Nature of Supramolecular Interactions and Crystal Engineering
3. Cation Binding Hosts Anion Binding and Neutral Molecule Binding
4. Supramolecular Reactivity and Catalysis
5. Biomimetic systems and artificial receptors
6. Molecular &Supramolecular Devices.

Unit -1: Basic concept and principles: **15 Hours**

History, Molecular recognition, Hydrogen Bonds: Definition, Structure and Stability, strength, Secondary Electrostatic Interactions in Hydrogen Bonding Arrays.

Nature of Supramolecular Interactions: Ion-ion Interactions, Ion-Dipole Interactions, Dipole-Dipole Interactions, π-π Interactions, Van der Waals Forces and Crystal Close Packing, Closed Shell Interactions, Ion pairing, Ion-Dipole Interactions, Dipole-Dipole interactions, Dipole-Induced Dipole and Ion-Induced Dipole interactions, van der Waals or Dispersion Interactions, Hydrogen bonding, Halogen bonding, Cation- interactions, Anion-pi interactions, Closed shell interactions, Aromatic-Aromatic Interactions: Benzene Crystals, Edge-to-face vs. pi-pi Stacking Interactions, N-H- pi interactions, Sulfur-aromatic interactions, Benzene-Hexafluorobenzene pi-stacking. Non-covalent interactions: Biological supramolecular systems: Ionophores, Porphyrin and other TetrapyrrolicMacrocycles, Coenzymes, Neurotransmitters, DNA and Biochemical Self-assembly.

Unit-2: Crystal Engineering: **22 Hours**

Concepts of Crystal Engineering, Understanding Crystal Structures, SupramolecularSynthons, Structure-Property Correlation, Design of Solids, Design of Properties, phase transformations, stimuli responsive solids, Topochemical (2+2) cycloadditions in cinnamic acids under light Topochemicalphotopolymerization in crystals, Crystal Engineering of Diamondoid Arrays Compounds, Self-Assembly of Closed Complexes: Catenanes and Rotaxanes. Helicates and Helical Assemblies. Molecular Knots by Hydrogen Bonding; Network Solids. Zeolites, Layered Solids and Intercalates, Coordination Polymers. Solid-State Chemistry Organic Crystal Structures, Supramolecular chirality and chirality imprinting Metal Organic Frameworks (MOFs), Covalent Organic Frameworks, Polymorphism, Co-Crystals, Salts.

UNIT-3

Unit-3: Supramolecular reactivity and Catalysis: **15 Hours**

Catalysis by reactiveMacrocycliccationsreceptormolecules, anion receptor molecules, supramolecularmetallocatalysis**,** biomolecular& abiotic catalysis. Transport processes & Carriers Design

Unit-4: Biomimetic systems and Artificial receptors: **20 Hours**

(a) Cation Binding Hosts -Podand, Crown Ether, Cryptand, Spherand; Nomenclature, Selectivity and Solution Behaviour; Alkalides, Electrides, Calixarenes and Siderophores.

(b) Anion binding hosts - Challenges and Concepts, Biological Receptors, Conversion of Cation Hosts to Anion Hosts, Neutral Receptors, Metal-Containing Receptors, Cholapods.

(c) Ion Pair Receptors - Contact Ion Pairs, Cascade Complexes, Remote Anion and Cation Binding Sites, Symport and Metals Extraction.

(d) Hosts for Neutral Receptors -Clathrates, Inclusion Compounds, Zeolites, Intercalates, Coordination Polymers, Guest Binding by Cavitands and Cyclodextrins, cucurbituril.

Unit-5: Molecular &Supramolecular Devices: **18 Hours**

Molecular recognition, Information & Signals; Supramolecular Photochemistry; Molecular &Supramolecular, Photonic & Electronic Devices; Molecular &Supramolecular Ionic Devices; Switching Devices & Signals.

RECOMENDED READINGS:

Books Recommended

1. J. M. Lehn, Supramolecular Chemistry, VCH, Weinheim, 19951.

2. Supramolecular Chemistry by J. W. Steed & J. L. Atwood, 2ndEdn John Wiley, 2009.

3. Crystal Engineering. The Design of Organic Solids by G.R. Desiraju, Elsevier, 1989.

M.Sc. CHEMISTRY THIRD SEMESTER

COURSE CODE: MSC 304D	**COURSE TYPE:ECC**
COURSE TITLE: **CHEMISTRY OF BIOMOLECULES**	
CREDIT: **THEORY: 6** **PRACTICAL:**	**HOURS:** **THEORY: 90** **PRACTICAL: 00**
MARKS: **THEORY: 70+30** **PRACTICAL:**	**MARKS** **THEORY:** **PRACTICAL:**

OBJECTIVE: To learn about Electron transport in biology, Transport and storage of oxygen. Study about Enzyme, Co-Enzyme, Metalloenzymes, Enzyme Models, Biopolymer intraction, Thermodynamics of Biopolymer solutions.

UNIT-1 20 Hours

A. BIOENERGETICS: Standard free energy change in biochemical reactions, exergonic, endergonic. Hydrolysis of ATP, synthesis of ATP from ADP.

B. ELECTRON TRANSFER IN BIOLOGY: Structure and function of metalloproteins in electron transport processes–cytochromes and Ion-sulphur proteins, synthetic models.

C. TRANSPORT AND STORAGE OF DIOXYGEN: Heme proteins and oxygen uptake, structure and function of haemoglobin, myoglobin, haemocyanins and haemerythrin, model synthetic complexes of iron, cobalt and copper.

UNIT-2 18 Hours

A. METALLOENZYMES: Zinc enzymes – carboxypeptibase and carbonic anhydrase. Iron enzymes – catalase, peroxidase and cytochrome P-450. Copper enzymes-superoxide dismutase. Molybdenum oxatransferase enzymes –xanthineoxidase.

B. ENZYME MODELS: Host-guest chemistry, chiral recognition and catalysis, molecular recognition, molecular asymmetry and prochirality. Biomimetic chemistry, Cyclodextrin-based enzyme models, calixarenes, ionophores, synthetic enzymes orsynzymes.

UNIT-3 20 Hours

A. ENZYMES: Nomenclature and classification of Enzyme. Induced fit hypothesis, concept and identification of active site by the use of inhibitors.

B. CO-ENZYME CHEMISTRY: Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD+, NADP+, FMN, FAD, lipoic acid, vitamin B12.

C. BIOTECHNOLOGICAL APPLICATIONS OF ENZYMES: Techniques and methods of immobilization of enzymes, effect of immobilization on enzyme activity, application of immobilization enzymes in medicine and industry. Enzymes and Recombinant DNA Technology.

UNIT-4 18 Hours

A. BIOPOLYMER INTERACTIONS: Forces involved in biopolymer interaction. Electrostatic charges and molecular expansion, hydrophobic forces, dispersion force interactions. Multiple equilibria and various types of binding processes in biological systems. Hydrogen ion titration curves.

B. THERMODYNAMICS OF BIOPOLYMER SOLUTIONS: Thermodynamics of biopolymer solution, osmotic pressure, membrane equilibrium, muscular contraction and energy generation in mechnochemical system.

UNIT-514 Hours

CELL MEMBRANE AND TRANSPORT OF IONS: Structure and functions of cell membrane, ion transport through cell membrane, irreversible thermodynamic treatment of membrane transport and Nerve conduction.

RECOMENDE READINGS:

1. Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books.

2. Bioinorganic Chemistry, I. Bertini, H.B. Gray, S.L. Lippard and J.S. Valentine, University Science Books.

3. Inorganic Biochemistry vols II and I.Ed G.L. Eichhorn, Elservier.

4. Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books.

5. Bioinorganic Chemistry, I. Bertinin, H.B. Gary, S.J. Lippard and J.S. Valentine, University Science.

6. Inorganic Biochemistry vols I and II ed. G.L. Eichhorn, Elsevier.

7. Bioorganic Chemistry: A Chemical Approach to Enzyme Action, Hermann Dugas and C. Penny, Springer-verlag.

8. Understanding Enzymes, Trevor palmer, PrenticeHall.

9. Enzyme Chemistry: Impact and Applications, Ed. Collin J Suckling, Chapman and Hall.

10. Enzyme Mechanisms Ed, M.I. PageandA. Williams, Royal Society of Chemistry.

11. Fundamentals of Enzymology, N.C.PriceandL. Stevens, Oxford University Press.

12. Immobilizaed Enzymes: An Introduction and Applications in Biotechnology, Michael D. Trevan, and John Wiley.

13. Enzymatic Reaction Mechanisms, C. Walsh, W.H. Freeman.

14. Enzyme Structure and Mechanisms, A. Fersht, W.H. Freeman.

15. Biochemistry: The Chemical Reacitonsfligingcells, D.E. Metzler, Academic Press.

16. Principles of Biochemistry, A.L. Lehninger, Wroth Publishers.

17. Biochemistry, L. Stryer, W.H. Freeman.

18. Biochemistry, J. David Rawn, Neil Patterson.

19. Biochemistry, Voet and Voet, John Wiley.

20. Outlines of Biochemistry, E.E. Conn and P.K. Stumpf, John Wiley.

21. Bioorganic Chemistry : A Chemistry Approach to Enzyme Action, H. Dugas and C. Penny, Springer-Verlag.

22. Biochemistry and Molecular Biology of Plants, Buchanan, Gruissem and Jones, I.K. International Pvt. Ltd.

23. L. Stryer, Biochemistry, 5th Edition, (2002) Freeman &Co. New York

24. D.L. Nelson and M.M. Cox, Lehninger Principles of Biochemistry 3rd Edition ((2002) McMillan North Publication

25. D. Voet, J. G. Voet, Biochemistry 3rd Edition (2004), Wiley International Publication

M.Sc. CHEMISTRY THIRD SEMESTER			
COURSE CODE: MSC 305			**COURSE TYPE: CCC**
COURSE TITLE: **LAB COURSE- I**			
CREDIT: **THEORY: 00**	**PRACTICAL:06**	**HOURS:** **THEORY: 00**	**PRACTICAL:135**
MARKS: **THEORY:**	**PRACTICAL: 100**	**MARKS** **THEORY:**	**PRACTICAL:**
Any Two experiments from the following are compulsory			

1. Determination of the partition coefficient for iodine between carbon tetrachloride & (a) Water,

(b) Aqueous potassium iodide.

2. Study of kinetics of exchange between ethyl iodide & the iodide ion.

3. Determination of the solubility product of lead iodide.

4. Determination of the dissociation constant of Barium Nitrate.

5. Determination of the concentration of iodine in a given sample (KI)by isotope dilution technique.

6. To study Reaction between Sodium Formate and Iodine by

a. Volumetric Method.

b. Conductometric Method.

7. Saponification of ethylacetate

a. Volumetric Method.

b. Conductometric Method.

8. To study the reaction between Acetone and Iodine.

9. To study the autocatalylic reaction between KMnO4 and Oxalic acid.

10. To study the reaction between K2S2O8 and Iodine.

11. Determination of pKa by Kinetic Measurement.

12. Evaluation of Equilibrium constants from kinetic data.

13. Determination of rate constant of the decomposition of benzene diazonium chloride at different temperature.

14. To study the photolysis of uranyl oxalate.

15. To study the effect of substate catalyst etc (i) HCl, K2S2O8 (ii) KOH, NaOH.

16. To study the Activation parameters.

17. To study the solvent effect using some Aprotic & Protic Solvents.

18. To examine the substituent effect (Hammette quation).

19. To study the effect of Electrolyte on the rate hydrolysis (KCl, NaCl,)

20. To study some simple enzyme catalyzed reaction.

21. To study the Micellar Catalyzed Reaction.

 Some advanced level sophisticated instrument based (FTIR, NMR, GC-MS, AAS, FLUORESCENCE SPECTROPHOTOMETER, TENSIOMETER etc.) experiments may be given to the students

	SUGGESTED BOOKS 1. Practical Physical Chemistry by Alexander Findlay. 2. Experimental Physical Chemistry, D.P. Shoemaker, C.W. Garland and J.W. Niber, McGraw Hill Inter science. 3. Findlay'sical Practial Chemistry, revised B.Phys. Levitt, Longman.
Mark Scheme:-	
Ex. 1 30 **Ex 2 30** **Sessional 20** **Viva 20**	
Total 100	

M.Sc. CHEMISTRY THIRD SEMESTER			
COURSE CODE: MSC 306			**COURSE TYPE: CCC**
COURSE TITLE: **LAB COURSE- II**			
CREDIT: **THEORY: 00**	**PRACTICAL:06**	**HOURS:** **THEORY: 00**	**PRACTICAL:135**
MARKS: **THEORY:**	**PRACTICAL: 100**	**MARKS** **THEORY:**	**PRACTICAL:**
Any Two experiments from the following are compulsory			

Sec A (25 Marks)

01. SPECTROPHOTOMETRIC DETERMINATIONS

A. Manganese / Chromium, Vanadium in steel sample.

B. Nickel / Molybdenum / Tungsten / Vanadium / Uranium by extractive spectrophotometric method.

C. Fluoride / Nitrate /Phosphate.

D. Iron –phenanthroline complex; Job'sMethod for determination of stability constant of complex.

E. Zirconium –Alizarin Red –S complex: Mole-ratio method.

F. Copper –Ethylenediamine complex: Slope-ratio method.

02. POLAROGRAPHY

Composition and stability constant of complexes.

Sec B (25 Marks)

01. pHMETRY

Stepwise proton-ligand and metal-ligand stability constant of complexes by Leving – Rossoti methods.

02. FLAME PHOTOMETRIC DETERMINATIONS.

(i) Sodium and potassium when present together

(ii) Lithium / Calcium / Barium /Strontium.

(iii) Calcium and Magnesium in tap water.

03. REFRACTOMETRY

1. Determination of the specific and molar refraction of a given liquid by Abbe Refractometer.

2. Determine the variation of refractive index.

3. To verify law of refraction of mixture (glycerol +water).

Sec C (10 Marks)

01. SEPARATION OF BINARY AND TERNARY

MIXTURES BY THE USE OF FOLLOWING SEPARATION TECHNIQUES:

1. Paper chromatography –Cadmium and Zinc, Zinc and Magnesium.

2. Thin–layer chromatography–separation of

(i) Nickel, Manganese, Cobalt and Zinc and determination of Rf values.

(ii) Sugars present in the given mixture of glucose, fructose and sucrose by paper chromategraphy and determination of Rf values.

3. Ion-exchange.

4. Solvent extraction.

5. Electrophoretic separation.

	02. ELECTROPHORESIS 1. To separate cations of inorganic salts by paper electrophoresis. 2. Capillary Electrophoresis of water soluble Vitamins.

SUGGESTED BOOKS

1. Quantitative Inorganic Analysis, A.I. Vogel.
2. Test book of Quantitative chemical Analysis, A.I. Vogel.
3. Practical Physical chemistry, A.M. James and F.E. Prichard, Longman.
4. Findley's Practical Physical Chemistry, B.P.Leviu7
5. Experimental Physical Chemistry, R.C. Das and B. Behera, Tata McGrawHill.

Mark Scheme:-

Ex-1	**25**
Ex -2	**25**
Ex -3	**10**
Sessional	**20**
Viva	**20**
Total	**100**