

Fourth 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 401	CCC	BIOLOGICAL CHEMISTRY	6	4	3	00
MSC 402	CCC	ELECTROCHEMICAL ENERGY, MATERIAL AND NUCLEAR CHEMISTRY	6	4	3	00	3	0	70	30
MSC 403	ECC	ELECTIVE1	6	4	3	00	3	0	70	30
MSC403	ECC	ELECTIVE II	6	4	3	00	3	0	70	30
MSC 403A	ECC/CB	HETEROCYCLIC COMPOUNDS AND MEDICINAL CHEMISTRY	6	4	3	00	3	0	70	30
MSC 403B	ECC/CB	Environmental Chemistry	6	4	3	00	3	00	70	30
MSC 403C	ECC/CB	INORGANIC RINGS, CHAINS, CLUSTERS AND INORGANIC MATERIALS								
MSC 403D	ECC/CB	INTRODUCTION TO NANOSCIENCE								
MSC 403E	ECC/CB	BIO-INORGANIC CHEMISTRY								

MSC 403F	ECC/CB	POLYMER CHEMISTRY								
MSC 403G	ECC/CB	TRIBAL STUDIES								
MSC 403H	ECC/CB	INTELLECTUAL PROPERTY, HUMAN RIGHTS AND ENVIRONMENT: BASICS								
MSC 405	CCC	LAB COURSE- I	6	0	0	09	0			100
MSC 406	CCC	DISSERTATION	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 FOURTH SEMESTER			
COURSE CODE:MSC 401COURSE TYPE: CCC			
COURSE TITLE:			
BIOLOGICAL CHEMISTRY			
CREDIT: THEORY: 6	PRACTICAL:0	HOURS: THEORY: 90	PRACTICAL: 00
MARKS: THEORY: 70+30	PRACTICAL:	MARKS THEORY:	PRACTICAL:
OBJECTIVE : To learn about molecules of life, their structure and function, metabolism, molecular recognition and Inorganic polymers.			
UNIT-118 Hours			
Molecules of life: Amino acids and proteins, Carbohydrates-polysaccharides, lipids, cell membranes and nucleic acids			
UNIT-2		18 Hours	
Structure and function: Protein structure, Ramachandran plot, protein folding: DNA/RNA structures, various forms (a, b, c, z) of DNA, t-RNA structure, transcription and translation, gene expression and DNA binding protein-zinc-finger protein.			
UNIT-3		18 Hours	
Metabolism and Energetics: Glycolysis , citric acid cycle , oxidative phosphorylation and transport through membranes.			
UNIT-4		17 Hours	
Enzymes, co-enzymes and their mechanism of action: Enzymes, Classification, Inhibition. Mechanism of action of chymotrypsin, aldolase, alcohol, lysozyme. Cofactors as derived from vitamins, co-enzymes, prosthetic, prosthetic group and apoenzymes. Structure and biological functions of coenzyme-A, thiamine pyrophosphate, pyridoxal phosphate, NAD ⁺ , NADP ⁺ , FAD, lipoic acid. Mechanisms of reactions catalysed by the above cofactors.			
UNIT-519Hours			
Molecular recognition: Molecular organization, Chiral recognition and role of sugar in biological recognition			

RECOMENDED READINGS:

1. L. Stryer, Biochemistry, 5th Edition, (2002) Freeman & Co. New York
2. D.L. Nelson and M.M. Cox, Lehninger Principles of Biochemistry 3rd Edition ((2002) McMillan North Publication
3. D. Voet, J. G. Voet, Biochemistry 3rd Edition (2004), Wiley International Publication.
4. I. Bertini, H. B. Gray, S. J. Lippard, J.S. Valentine, 1st South Asian Edn., (1998) Viva Books Pvt. Limited, New Delhi
5. M. B. Smith, Organic Synthesis, (1998) McGraw Hill Inc, New York

M.Sc. CHEMISTRY FOURTH SEMESTER			
COURSE CODE: MSC 402		COURSE TYPE: CCC	
COURSE TITLE:			
ELECTROCHEMICAL ENERGY, MATERIAL AND NUCLEAR CHEMISTRY			
CREDIT:		HOURS:	
THEORY:	PRACTICAL:0	THEORY:	PRACTICAL:
6		90	00
MARKS:		MARKS	
THEORY:	PRACTICAL:	THEORY:	PRACTICAL:
70+30			
OBJECTIVE : To study about electrochemical energy, material chemistry, supramolecular chemistry, nuclear chemistry and radiochemistry.			
UNIT-1		15 Hours	
ELECTROCHEMICAL ENERGY			
Batteries, supercapacitors. Energy conversion devices. Electrocatalysis and Fuel cell. Water splitting, hydrogen and oxygen evolution reactions, oxygen reduction reaction. Electrochemical sensors, electrochemical biosensors and gas sensors.			
UNIT-2		20 Hours	
MATERIAL CHEMISTRY:			
Preparation and Properties of Nanoparticles, Materials-Metals, Ceramics (Oxide, carbides, sulphides, nitrides). Physical and Chemical Methods, Size and Shape controlled Synthesis, Sol-gel methods, Optical Properties, Electrical and Magnetic Properties, Application of Nanoparticles.Characterization of Nanoparticles(SEM, TEMetc.)			
UNIT-3		20 Hours	
SUPRAMOLECULAR CHEMISTRY:			
Properties of covalent bonds, bond length, inter bond angles, Force constant, bond and molecular dipole moment, molecular and bond polarizability.			
Intermolecular Forces, hydrophobic effects, Electrostatic, induction, dispersion and resonance energy, Hydrogen bond, Magnetic interactions. Principles of molecular association and organization. Biological macromolecules, Molecular receptors and design principle, cryptands, Cyclophanes, calixarenes and cyclodextrins.			
Supramolecular reactivity and catalysis.			

UNIT-4**20 Hours**

NUCLEAR CHEMISTRY: Nuclear cross section and nuclear radii, nuclear shells and magic numbers, theory of nuclear shell model, nuclear potentials, square well and simple harmonic oscillator potentials, application, liquid drop model, semi-empirical mass equation, application and limitations.

NUCLEAR FISSION:

Mass, energy and charge distribution of fission products, decay chains, prompt and delayed neutrons, liquid drop model of nuclear fission.

NUCLEAR ENERGY:

Nuclear fission, chain reaction, multiplication factor, nuclear reactors.

UNIT-5**15 Hours****RADIOCHEMISTRY:**

Radioactive isotopes, purity and strength of radioisotopes. Radiochemical principle in the use of tracers, Application of Tracers in Chemical investigations, Physico-chemical methods, Analytical applications, Age determinations, Medical applications, Agricultural application.

RECOMENDED READINGS:

1. Nuclear and Radio chemistry by G. Friedlander, J.W. Kennedy & J.M. Miller, John Wittey and Sons, Ine New York.
2. Source Book Atomic Energy–S. Glasstone, Affiliated East–West Press Pvt. Ltd. New Delhi.
3. Nuclear Physics by I. Kaplan, Addision –Welsly. Publishing company London.
4. Nuclear Chemistry and its applications, M. Haissinsky, Addision– Welsley, Publishing Company, London.
5. Essentials of Nuclear chemistry, H.J. Arnikaar, Wiley Eatern Ltd, New Delhi.
6. Molecular Mechanics, U. Burkert and N.L. Allinger, ACS Monograph 177, 1982.
7. Mechanism and Theoryin Organic Chemistry, T.H. Lowry and K.C. Richrdson, Harper and Row.
8. Introduction to Theoretical Organic Chemistry and Molecular, Modelling, W.B. Smith, VCH, Weinheim.
9. Physical Organic Chemistry, N.S. Isaacs, ELBS./Longman.
10. Supramolecular Chemistry: concept and Perspectives, J.M. Lehn, VCH.
11. Quantum Chemistry, Ira N. Levine, PrenticeHall.
12. Introduction to Quantum Chemistry, A.K. Chandra, Tata McGrawHill.

M.Sc. CHEMISTRY FOURTH SEMESTER			
COURSE CODE: MSC 403A		COURSE TYPE: ECC	
COURSE TITLE:			
HETEROCYCLIC COMPOUNDS AND MEDICINAL CHEMISTRY			
CREDIT:		HOURS:	
THEORY:	PRACTICAL:	THEORY:	PRACTICAL:
6		90	00
MARKS:		MARKS	
THEORY:	PRACTICAL:	THEORY:	PRACTICAL:
70+30			
<p>1. OBJECTIVE : The objective of this course is to provide knowledge about the fundamentals reactions of heterocyclic compounds and their application as drugs. To develop understanding about the effect of structural modification of the drug on their activities. To develop understanding about the various synthetic and retrosynthetic approaches adopted in the synthesis of diverse range of drugs. In addition to that medicinal importance of the different drugs will also be highlighted</p>			
UNIT-1		20 Hours	
Heterocyclic Chemistry			
<p>General Considerations: Structure, synthesis and reactivity. Synthesis and reactions of the following ring systems: Three-membered rings: Aziridines; Four-membered rings: Azetidines; and their 2-oxo derivatives; Five-membered rings containing two heteroatoms: Oxzoles, Imidazoles, Thiazoles, Isoxazoles, Pyrazoles, Pyrimidines, Purines: Uric acid and Caffeine.</p>			
UNIT-2		20 Hours	
Structure and activity			
<p>Relationship between chemical structure and biological activity(SAR). Receptor Site Theory. Approaches to drug design. Introduction to combinatorial synthesis in drug discovery. Drugs based on a substituted benzene ring: Chloramphenicol, salmeterol, tolazamide, diclophenac, Amlodipine, Amitriptyline</p>			
UNIT-3		20 Hours	
Drugs based on five & six membered heterocycles			
<p>spiralpril, oxaprozine, sulconazole, nizatidine, imolamine, isobuzole. Warfarin, quinine, norfloxacin and ciprofloxacin.</p>			

UNIT-4**15 Hours****Drugs based on seven-membered heterocyclic rings fused to benzene**

Chlordiazepoxide, diazepam, diltiazem.

UNIT-5**15 Hours****Drugs based on heterocycles fused to two benzene rings:**

Quinacrine, tacrine, β -Lactam antibiotics: Penicillin, cephalosporin. Drugs based on five-membered heterocycles fused to six-membered rings: Acyclovir, methotrexate. New Chemical Entities as Clinical agents, Synthetic: Ritonavir, erbumine, Natural: Hamamelitannin, pinophilin A & B.

RECOMENDED READINGS:

1. T. L. Gilchrist, *Heterocyclic Chemistry*, 3rd Edition (1997) Addison-Wesley Longman Ltd., England
2. R. K. Bansal, *Heterocyclic Chemistry: Syntheses, Reactions and Mechanisms*, 3rd Edition (1999), New Age International, Publisher, New Delhi.
3. A. Burger, *Medicinal Chemistry*, Vol. I-III, (1995) Wiley Interscience Publications, New York.
2. W. O. Foye, *Principles of Medicinal Chemistry*, 3rd Edition (1989), Lea &Febiger/Varghese Publishing House, Bombay.
3. D. Lednicer and L. A. Mitscher, *The Organic Chemistry of Drug Synthesis*, (1977) Vol. III, Wiley Interscience.
4. A. Kar, *Medicinal Chemistry*, (1993) Wiley Eastern Ltd., New Delhi.
5. N. K. Terrett, *Combinatorial Chemistry*, (1998) Oxford Univ. Press, Oxford.
6. Daniel Lednicer *Strategies for organic drug synthesis and design* (2009), John Wiley & Sons, New York.

M.Sc. CHEMISTRY FOURTH SEMESTER			
COURSE CODE: MSC 403B		COURSE TYPE: ECC	
COURSE TITLE:			
ENVIRONMENTAL CHEMISTRY			
CREDIT:		HOURS:	
THEORY:	PRACTICAL:	THEORY:	PRACTICAL:
6		90	00
MARKS:		MARKS	
THEORY:	PRACTICAL:	THEORY:	PRACTICAL:
70+30			
OBJECTIVE: To develop understanding about the different aspects of environmental chemistry.			
UNIT-1		14 Hours	
PRINCIPLES OF ENVIRONMENTAL CHEMISTRY			
Role, importance and scope of environmental chemistry, multidisciplinary nature Concept of an ecosystem, structure and function of an ecosystem, energy and nutrient flow, biogeochemical cycles, sources, pathways and fate of environmental pollutants-Environmental transformation & degradation processes.			
UNIT-2		24 Hours	
ATMOSPHERIC CHEMISTRY			
Chemical composition of the earth's atmosphere, units for expressing atmospheric concentration Various segments of atmosphere & their significance, sources and toxic effects of air pollutants, Stratospheric Chemistry- Ozone formation & turnover of ozone, processes for catalytic decomposition of ozone, chlorofluorocarbons, arctic & Antarctic ozone hole formation. Tropospheric Chemistry- Smog, Phototransformation, types of hydrocarbon in the troposphere, reaction of organic compounds in the atmosphere. Chemistry of photochemical smog, emissions from internal combustion engine and control measures , sulfurous smog & emissions from stationary sources and control measures Tropospheric Chemistry – Precipitation .acid rains, sources & sinks. Atmospheric Aerosols: Sources of aerosols, aerosol concentrations & life times, PM -2.5 & its significance, control of particulate emissions The chemistry of global climate: energy balance & the earth's atmosphere, greenhouse gases & global warming.			

UNIT-3**22 Hours****AQUATIC CHEMISTRY THE HYDROSPHERE**

physical & chemical properties of water, concentration units used for aqueous solutions, Water resources, Chemistry of natural waters, physico-chemical properties of water, Water pollution: Deoxygenating substances, influence of chemical process on dissolved oxygen, sources of water pollution, various pollutants their detrimental effects. Portability limits as per WHO & PHED specification, treatment of municipal supply water, slow sand filters, rapid sand filter, disinfections, their advantage & disadvantages, break point chlorination, Commonly used water purification techniques.

UNIT-4**15 Hours****SOIL CHEMISTRY AND SOIL FORMATION**

Physical weathering, chemical weathering, Composition of soil, micro and macro nutrients, Physical & chemical properties of soil. Sources and chemical nature of soil contaminants, Distribution of soil contaminants: Soil –water partition process, soil- organism processes, Ecological and health effects of soil contaminants.

UNIT-5**15 Hours****CHEMISTRY OF SOLID WASTES**

Sources, Classification and composition of MSW, Properties of MSW, MSW management, Waste minimization, Life cycle assessment, benefits, waste reduction techniques, Reuse and recycling, Biological MSW treatment, Thermal treatment, Landfill, Integrated waste management. Radiation hazards: Types of radiation, sources, effects, control and disposal of nuclear waste.

RECOMENDED READINGS:

1. Environmental Chemistry: a global perspective, G.W.van Loon, S.J. Duffy, Oxford publication
2. Practical Environmental Analysis by Miroslav Radojevic and Vladimir N. Bashkin, RSC.
3. An Introduction to Environmental Science & Engineering by Gilbert M. Masters.
4. Environmental Chemistry, S.E. Manahan, Lewis Publishers.
5. Environmental chemistry, Sharma and Kaur, Krishna Publishers.
6. Environmental Chemistry, A.K. De, Wiley Eastern.
7. Environmental Chemistry, Analysis, S.M. Khopkar, Wiley Eastern.
8. Standard Method of Chemical Analysis, F.J. Welcher Vol. III, Van Nostr and Reinhold Co.
9. Environmental Toxicology, Ed.J. Rose, Gordon and Breach Science Publication.
10. Environmental Chemistry, C. Baird, W.H. Freeman.

M.Sc. CHEMISTRY FOURTH SEMESTER			
COURSE CODE: MSC 403C		COURSE TYPE: ECC	
COURSE TITLE:			
INORGANIC RINGS, CHAINS, CLUSTERS AND INORGANIC MATERIALS			
CREDIT:		HOURS:	
THEORY:	PRACTICAL:	THEORY:	PRACTICAL:
6		90	00
MARKS:		MARKS	
THEORY:	PRACTICAL:	THEORY:	PRACTICAL:
70+30			
OBJECTIVE: To develop understanding about the different aspects of rings, clusters and inorganic materials.			
UNIT-1		14 Hours	
<p>Unit-1: Clusters and element-element bonds: Polyhedral boranes: Electron deficiency vs sufficiency. Types and IUPAC nomenclature. Wade's polyhedral skeleton electron pair theory (PSEPT). W. N. Lipscomb's styx rules and semi-topological structures of boranes. Equivalent and resonance structures. Wade's vs Lipscomb's methods of studying higher boranes.</p>			
UNIT-2		24 Hours	
<p>Unit-2: Heteroboranes: Types of heteroboranes with special reference to carboranes, structure, bonding and IUPAC nomenclature. Metallaboranes, Metallocarboranes, metal σ and π bonded borane/carborane clusters. Resemblance of Metallaboranes / Metallocarboranes with ferrocene and related compounds. Applications of Metallaboranes / Metallocarboranes as drug delivery system. Applications of PSEPT over heteroboranes.</p>			
UNIT-3		22 Hours	
<p>Unit-3: Principle of Isolobility: Development and formulation of the concept of isolobility and its applications in the understanding of structure and bonding of heteroboranes</p>			

UNIT-4**15 Hours**

Unit-4: Metal Clusters: Metal-metal bonds. Concept of quadrupolar bond and its comparison with a C-C bond; Types of metal clusters and multiplicity of M-M bonds. Simple and condensed metal carbonyl clusters. Applications of PSEPT and Wade's-Mingo's and Lauhr's rule over metal carbonyl clusters. Metal halide and metal chalcogenide clusters: Bloomington schuffle in dinuclear tungsten clusters. Heteropoly and Isopoly acids: Structural principles and their applications

UNIT-5**15 Hours**

Unit-5: Inorganic Polymers: 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.

RECOMENDED READINGS:

1. F. A. Cotton and G. Wilkinson, *Advanced Inorganic Chemistry*, 6th Edn. (1999), John- Wiley & Sons, New York.
2. James E. Huheey, *Inorganic Chemistry*, 4th Edn. (1993), Addison Wesley Pub. Co., New York
3. N. N. Greenwood and A. Earnshaw, *Chemistry of the Elements*, 2nd Edn. (1997), Butterworth Heinemann, London.

M.Sc. CHEMISTRY FOURTH SEMESTER			
COURSE CODE: MSC 403D		COURSE TYPE: ECC	
COURSE TITLE:			
INTRODUCTION TO NANOSCIENCE			
CREDIT:		HOURS:	
THEORY:	PRACTICAL:	THEORY:	PRACTICAL:
6		90	00
MARKS:		MARKS	
THEORY:	PRACTICAL:	THEORY:	PRACTICAL:
70+30			
OBJECTIVE: The primary objective of this course is:			
<ol style="list-style-type: none"> 1. To develop fundamental knowledge of the Nanoscience and related fields. 2. To make the students acquire an understanding the synthesis process of nanomaterials, characterization techniques and their applications in various fields. 			
UNIT-1		14 Hours	
Unit 1:Background to Nanoscience:			
Basic concepts of Nanoscience and Nanotechnology, Significance of Nanoscale, Classification of nanomaterials, emergence and challenges of nanoscience and nanotechnology, carbon age-new form of carbon (fullerene, CNT, graphene, diamond), influence of nano over micro/macro, size effects, large surface to volume ration, surface effects on the properties.			
UNIT-2		24 Hours	
Unit 2:Types of Nanostructure and Properties of Nanomaterials:			
One dimensional, Two dimensional and Three dimensional nanostructured materials, Quantum Dots shell structures, metal oxides, semiconductors, composites, mechanical-physical-chemical properties.			
UNIT-3		22 Hours	
Unit 3:Synthesis of Nanostructure Materials:			
Top down and Bottom up approach, Ball milling, Vacuum deposition, Physical Vapor Deposition (PVD): Thermal evaporation, E-beam evaporation, Pulsed Laser deposition, Chemical Vapor Deposition (CVD), Sol-Gel, Spray pyrolysis, Hydrothermal synthesis, Metal nanocrystals by reduction, Liquid-liquid interface, Solvated metal atom dispersion, Photochemical synthesis.			

UNIT-4**15 Hours****Unit 4: Characterization of Nanostructures (Structural Characterization):**

X-ray diffraction, Optical Microscopy and their description, Scanning Electron Microscopy (SEM), TEM, Atomic force Microscopy (AFM), Basic concepts of spectroscopy, Spectroscopy of Nanomaterials (X-ray Photoelectron study, Principle and Applications)

UNIT-5**15 Hours****Unit 5: Nanocomposites and Applications:**

An Introduction: Types of Nanocomposite (i.e. metal oxide, ceramic, glass and polymer based); Core-Shell structured Nanocomposites Superhard Nanocomposite: Synthesis and applications.

RECOMENDED READINGS:

- Nanomaterials- Synthesis, Properties and Applications, Edited by A.S. Edelstein and R.C. Cammarata, Institute of Physics Publishing, London, 1998 (paper back edition)
2. Nanochemistry: A Chemical Approach to Nanomaterials, by G. Ozin and A. Arsenault, RSC Publishing, 2005
 3. C.P. Poole, Jr. Frank J. Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.).
 4. S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publishing Company).
 5. Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).
 6. M. Hosokawa, K. Nogi, M. Naita, T. Yokoyama, Nanoparticle Technology Handbook

M.Sc. CHEMISTRY FOURTH SEMESTER			
COURSE CODE: MSC 403E		COURSE TYPE: ECC	
COURSE TITLE:			
BIOINORGANIC CHEMISTRY			
CREDIT:		HOURS:	
THEORY:	PRACTICAL:	THEORY:	PRACTICAL:
6		90	00
MARKS:		MARKS	
THEORY:	PRACTICAL:	THEORY:	PRACTICAL:
70+30			
OBJECTIVE:			
<p>1. To learn the role of various metals and metal complexes in different biological and transport systems.</p> <p>2. To learn about various metalloenzymes and interaction of metals complexes with DNA.</p>			
UNIT-1		15 Hours	
<p>Unit-1: Role of alkaline earth metal ions in biological systems : (i) Catalysis of phosphate transfer by Mg^{2+} ion, (ii) Ubiquitous regulatory role of Ca^{2+} in muscle contraction</p>			
UNIT-2		22 Hours	
<p>Unit-2: Iron, copper and molybdenum proteins with reference to their oxygenation and oxidase activity: (i) Anti-oxidative functions: cytochrome P-450, catalases and peroxidases, (ii) Nitrate and nitrite reduction: NO_3 and NO_2 reductase, (iii) Electron transfer: cytochromes; blue copper proteins and iron-sulfur proteins and their Synthetic models, (iv) molybdo-enzymes – molybdenum cofactors : molybdenum-pterin? complexes, (v) Nitrogen fixation through metal complexation, nitrogenase, (vi) Photosynthesis (PS-I and PS-II).</p>			
UNIT-3		15 Hours	
<p>Unit-3: Metalloenzymes: Urease, Hydrogenase, and Cyanocobalamine</p>			
UNIT-4		20 Hours	
<p>Unit-4: Interaction of metal complexes with DNA: DNA probe and chemotherapeutic agents Role of metal ions in replication and transcription process of nucleic acids. Biochemistry of dioxygen, bioinorganic chips and biosensors.</p>			

UNIT-5

18 Hours

Unit-5: Iron storage and transport proteins: Ferritin, Transferritin and Hemosiderin. Oxygen Transport and Storage through Hemoglobin and Myoglobin, Alternative Oxygen Transport: Hemerythrin and Hemocyanin.

RECOMENDED READINGS:

1. M. N. Hughes, *Inorganic Chemistry of Biological Processes*, 2nd Ed.(1981), John-Wiley & Sons, New York.
2. W. Kaim and B. Schwederski, *Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life, An Introduction and Guide*, Wiley, New York (1995).
3. S. J. Lippard and J. M. Berg, *Principles of Bioinorganic Chemistry*, University Science Books, (1994).
4. I. Bertini, H. B. Grey, S. J. Lippard and J. S. Valentine, *Bioinorganic Chemistry*, Viva Books Pvt. Ltd., New Delhi (1998)

M.Sc. CHEMISTRY FOURTH SEMESTER			
COURSE CODE: MSC 403F		COURSE TYPE: ECC	
COURSE TITLE:			
POLYMER CHEMISTRY			
CREDIT:		HOURS:	
THEORY:	PRACTICAL:	THEORY:	PRACTICAL:
6		90	00
MARKS:		MARKS	
THEORY:	PRACTICAL:	THEORY:	PRACTICAL:
70+30			
OBJECTIVE: To study about polymer introduction, mechanism of polymerization, polymer solutions, polymer structure and physical properties and specialty polymers.			
UNIT-1		15 Hours	
Introduction: Classification of polymers, intermolecular forces in polymers.			
UNIT-2		22 Hours	
Mechanism and kinetics of step-growth and chain growth polymerization: Radical, cationic, anionic and condensation polymerization, copolymerization, reactivity ratios, thermodynamic aspects of polymerization, mechanism of living radical polymerizations: nitroxide mediated polymerization (NMP), metal-catalyzed living radical polymerization, reversible addition-Fragmentation Chain Transfer (RAFT) radical polymerization, coordination polymerization, ring opening polymerization, click chemistry.			
UNIT-3		15 Hours	
Polymer solutions: Flory-Huggins theory of polymer solutions, nature, size and shape of macromolecules in solution.			
UNIT-4		20 Hours	
Polymer structure and Physical properties: Microstructure of polymer chains, crystallinity in polymers, glass transition temperature, rheological properties, molecular weight and its distribution.			
UNIT-5		18 Hours	
Specialty polymers: Liquid crystalline polymers, conducting polymers, electroluminescent polymers, inorganic polymer, nanocomposites of polymers, biomedical polymers.			

RECOMENDED READINGS:

1. Text Book of Polymer Science, 3rd Edition (1984), F. W. Billmayer, Jr., Willey-Interscience, New York.
2. Physical Chemistry, 8th Edition, P. W. Atkins, Oxford University Press, New York. YEAR
3. Principles of Polymerization, 3rd Edition (1991) G. Odian, John Wiley, Singapore
4. Principle of Polymer Sciences, P. Bahadur and N.V. Sastry, Narosa Publishing House, New Delhi (2002)
5. Polymer Sciences, V.R. Gowarikar, N.V. Vishwanathan, J. Shreedhar , Wiley Eastern, New Delhi (1986)

M.Sc. CHEMISTRY FOURTH SEMESTER

COURSE TITLE: TRIBAL STUDIES

CREDIT: 06

HOURS : 90

THEORY: 06

THEORY: 90

MARKS : 100

THEORY: 70 CCA : 30

OBJECTIVE:

- Understands the concept and place of research in concerned subject
- Gets acquainted with various resources for research
- Becomes familiar with various tools of research
- Gets conversant with sampling techniques, methods of research and techniques of analysis of data
- Achieves skills in various research writings
- Gets acquainted with computer Fundamentals and Office Software Package .

UNIT -1

12 Hours

Tribal Studies : Meaning, Nature, Scope, Need & importance of tribal studies. Meaning, Definition & characteristics of Tribe, Caste & Race.

UNIT -2

24 Hours

Scheduled Tribe in India : Population Composition of tribal, classification of Indian Tribe – Racial, Lingual, Geographical, Cultural.

Some Major Tribes in India : Santhal, Khasi, Munda, Bhils.

Some Major Tribes in Central India : Gond, Baiga, Bharia, Korkus.

UNIT -3

10 Hours

Illiteracy :Poverty, Indebness, Unemployment, migration & Exploitation Environmental & Degradation.

Problem of Health and sanitation :

Prostitution, Culture Decay due to assimilation. Replacement & Rehabilitation of Tribal population.

UNIT -4

24 Hours

Welfare-Concept, Characteristics: Tribal Welfare in post independence period. Constitutional provision & safe guard after independence, Legislation & Reservation Policy.

UNIT -5

20 Hours

Tribal Development Programs for Scheduled Tribes : Medical, Education, Economy, Employment & Agriculture
Evaluation of Programs

Tribal Welfare & Advisory Agencies in India : Role of NGO's in tribal development, Role of Christian missionaries in tribal welfare & development. Tribal Welfare Administration.

SUGGESTED READINGS

1. *Tribal Development In India (Orissa)* by Dr. Taradutt
2. *Books on Tribal studies* by PK Bhowmik
3. *Books on 'Tribal Studies'* by W.G. Archer

M.Sc. CHEMISTRY FOURTH SEMESTER	
COURSE CODE: MSC403H	COURSE TYPE : ECC/CB
COURSE TITLE:INTELLECTUAL PROPERTY RIGHTS, HUMAN RIGHTS & ENVIRONMENT: BASICS	
CREDIT: 06	HOURS : 90
THEORY: 06	THEORY: 90
MARKS : 100	
THEORY: 70	CCA : 30
OBJECTIVE:	
<ul style="list-style-type: none"> - Understands the concept and place of research in concerned subject - Gets acquainted with various resources for research - Becomes familiar with various tools of research - Gets conversant with sampling techniques, methods of research and techniques of analysis of data. 	
UNIT - 1 12 Hrs	<ul style="list-style-type: none"> • Patents :- Introduction & concepts, Historical Overview. • Subject matter of patent. • Kinds of Patents. • Development of Law of Patents through international treaties and conventions including TRIPS Agreement. • Procedure for grant of patents & term of Patent. • Surrender, revocation and restoration of patent. • Rights and obligations of Patentee • Grant of compulsory licenses • Infringement of Patent and legal remedies • Offences and penalties • Discussion on leading cases.
UNIT - 2 24 Hrs	<ul style="list-style-type: none"> • Meaning of Copyright, Historical Evolution, • Subject matter of copyright. • Literary works • Dramatic Works & Musical Works • Computer Programme • Cinematographic films • Registration of Copyrights • Term of Copyright and Ownership of Copyrights • Neighboring Rights • Rights of Performers & Broadcasters • Assignment of Copyright. • Author's Special Rights (Moral Rights) • Infringement of Copyrights and defenses • Remedies against infringement (Jurisdiction of Courts and penalties) • International Conventions including TRIPS Agreement WIPO, UCC, Paris Union, Berne Convention, UNESCO. • Discussion on leading cases.

UNIT - 3 10 H rs	<ul style="list-style-type: none"> • Rights: Meaning • Human Rights- Meaning & Essentials • Human Rights Kinds • Rights related to Life, Liberty, Equals & Disable
UNIT - 4 24 Hrs	<ul style="list-style-type: none"> • National Human Rights Commission • State Human Rights Commission • High Court • Regional Court • Procedure & Functions of High & Regional Court.
UNIT - 5 20 Hrs	<ul style="list-style-type: none"> • Right to Environment as Human Right • International Humanitarian Law and Environment • Environment and Conflict Management • Nature and Origin of International Environmental Organisations (IEOs) • Introduction to Sustainable Development and Environment • Sustainable Development and Environmental Governance
SUGGESTED READINGS	<ol style="list-style-type: none"> 1. G.B.Reddy, <i>Intellectual Property Rights and Law</i>, Gogia Law Agency, Hyderabad. 2. S.R.Myneni, <i>Intellectual Property Law</i>, Eastern Law House, Calcutta 3. P Narayanan <i>Intellectual Property Rights and Law (1999)</i>, Eastern Law House, Calcutta, India 4. VikasVashistha, <i>Law and Practice of Intellectual Property</i>,(1999) Bharat Law House, New Delhi. 5. Comish W.R <i>Intellectual Property</i>,3rded, (1996), Sweet and Maxwell 6. P.S. Sangal and Kishor Singh, <i>Indian Patent System and Paris Convention</i>, 7. Comish W.R <i>Intellectual Property, Patents, Copyrights and Allied Rights</i>, (2005) 8. BibeckDebroy, <i>Intellectual Property Rights</i>, (1998), Rajiv Gandhi Foundation.

M.Sc. CHEMISTRY FOURTH SEMESTER			
COURSE CODE: MSC 405		COURSE TYPE: CCC	
COURSE TITLE:			
LAB COURSE- I			
CREDIT:		HOURS:	
THEORY: 00	PRACTICAL:06	THEORY: 00	PRACTICAL:135
MARKS:		MARKS	
THEORY:	PRACTICAL: 100	THEORY:	PRACTICAL:
One Experiment from each section is compulsory			
<p>Sec-A (25 marks)</p> <p>A. MULTI - STEP SYNTHESIS OF ORGANIC COMPOUNDS</p> <p>(i) Beckmann Rearrangement: Benzanilide from benzene (Benzene Benzophenone Benzo phenoneoxime Benzanilide).</p> <p>(ii) Benzilic Acid Rearrangement: Benzilic acid from Benzoin (Benzoin Benzil Benzilic acid)</p> <p>(iii) Skraup's synthesis (Synthesis of heterocyclic Quinoline from o – Aminophenol)</p> <p>(iv) p –Bromoaniline from Aniline (Aniline Acetanilide p - Bromoacetanilide p - Bromoaniline)</p> <p>(v) p –Nitroacetanilide from Acetanilide (Aniline Acetanilide p - Nitroacetanilide p - Nitroaniline)</p> <p>(vi) m –Nitroaniline from Benzene (Benzene Nitrobenzene m - dinitrobenzene m - nitroaniline)</p> <p>(vii) Acridone from Anthranilic acid (Anthranilic acid o - Chlorobenzoic acid N - Phenylanthranilic acid Acridone)</p> <p>(viii) Enzymatic Synthesis Enzymatic reduction: Reduction of ethylaceenantimeric Excess of S (+) ethyl - 3 - hydroxybutanone and determine its optical purity.</p>			

Sec-B (20 marks)

A. QUANTITATIVE ORGANIC ANALYSIS

- (i) Estimation of Sulphur by Messenger's Method.
- (ii) Estimation of Nitrogen by Kjeldahl Method.

B. ESTIMATION OF FUNCTIONAL GROUP

- (i) Estimation of Aniline.
- (ii) Estimation of Amino Group By Acetylation Method.
- (iii) Estimation of Hydroxyl Group By Acetylation Method.
- (iv) Estimation of Carbonyl Group By Hydrazone Formation Method.
- (v) Estimation of Carboxyl Group By Titration Method.
- (vi) Determination of Equivalent Weight of Carboxylic Acid By Silver Salt Method.
- (vii) Estimation of Glucose By Fehling Solution Method.
- (viii) Estimation of Glycine By Titration Method.

Sec-C (15 marks)

A. EXTRACTION OF ORGANIC COMPOUNDS FROM NATURAL SOURCES

- (i) Isolation of caffeine from leaves.
- (ii) Isolation of Casein from milk.
- (iii) Isolation of lactose from milk.
- (iv) Isolation of nicotine dipicrate from tobacco.
- (v) Isolation of Cinchonine from cinchona bark.
- (vi) Isolation of Piperine from blackpepper.
- (vii) Isolation Lycopene from tomatoes.
- (viii) Isolation of β -Carotene from carrots.
- (ix) Isolation of Limonene from citrus rinds.
- (x) Isolation of protein and carbohydrates from seeds –colour test
- (xi) Extraction of Fatty oil from seeds and determination of refractive index of the oil.
- (xii) Isolation of protein and carbohydrate (as reducing sugars) from seed-colour test.

B. MISCELLANEOUS

- (i) Nutrient and micronutrient analysis in plant/soil/sediment.
- (ii) Speciation of toxic metals i.e. As, Hg, Se, etc.
- (iii) Analysis of clinical samples i.e. blood, urine, hair, etc

SUGGESTED BOOKS

1. Practical Organic chemistry by A. I.Vogel.
2. Practical Organic chemistry by Mann and Saunders.
3. Practical Organic chemistry by Gargand Saluja.
4. The Systematic Identification of Organic compounds, R.L. Shriner and D.Y. Curtin.
5. Semimicro Qualitative Organic Analysis, N.D. Cheronis, J.B. Entrikin and E.M. Hodnett.
6. Experimental Organic chemistry, M. P. Doyle and W. S. Mungall.
7. Small Scale Organic preparation, P. J. Hill.
8. Experimental Biochemistry, by B.S. Roa and V. Deshp and e.I.K. International Pvt. Ltd.
9. Comprehensive Practical Organic Chemistry, Preparation and Qualitative Analysis, V.K. Ahluwalia and Renu Aggarwal, University Press.
10. Quantitative Inorganic Analysis, A.I. Vogel.
11. Standard Methods of Water Analysis.
12. Colorimetric Determination of Traces of Metals, E.B. Sandell.
13. GBC, Manuals on AAS analysis, Austria.

Mark Scheme:-

Ex. 1	25
Ex 2	20
Ex 3	15
Sessional	20
Viva	20
Total	100

M.Sc. CHEMISTRY FOURTH SEMESTER			
COURSE CODE: MSC 406		COURSE TYPE: PRJ/CCC	
COURSE TITLE:			
DISSERTATION			
CREDIT:		HOURS: 90	
THEORY: 80+20	PRACTICAL:	THEORY:90	PRACTICAL:00
MARKS:		MARKS	
THEORY:	PRACTICAL:	THEORY:	PRACTICAL:
The following topics have been proposed by the Board of studies in chemistry for completion of M.Sc. IV Semester. Any one major heading may be chosen for writing Dissertation			
<ol style="list-style-type: none"> 1. Soil Analysis 2. Cosmetics 3. Water Analysis 4. Food Adulteration 5. Medicinal Plant 6. Nanotechnology 7. Spectroscopic techniques in Characterisation 8. Air quality 9. Chemiluminiscence 10. Material Science 11. Drug Delivery 12. Phytochemistry 13. Biochemistry 14. Surfactants 15. Ligand Chemistry 			
Dissertation Proforma			
Preface			
Acknowledgement			
Certificate			
Declaration			
<ol style="list-style-type: none"> 1. Introduction 2. Review of Literature 3. Method and Materials 4. Result and Discussion 5. Conclusion 			

6. Reference