M.Sc. CHEMISTRY FOURTH SEMESTER

COURSE CODE: MSC 401 **COURSE TYPE: CCC**

COURSE TITLE:

BIOINORGANIC CHEMISTRY

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

OBJECTIVE : To learn about Trace metal ions, Enzymes and medicinal bio inorganic chemistry.

UNIT-1/ 18 Hours	ESSENTIAL AND TRACE METAL IONS Alkali and alkaline earth and transition metal cations. Crown ethers, Na & K ion transport, Metal ion toxicity in biochemical system. Bio membranes and calcium carriers.
UNIT-2/ 18 Hours	RESPIRATORY PROTEINS Heme-oxygen carrier: Introduction, Models for transports Heme iron proteins, porphyrin system, substituent effects. Oxygen carriers- Haemoglobin, Myoglobin- structural characteristics and Bohr effect. Non-heme oxygen carriers: Hemerythrin and hemocyanin, Model compounds for oxygen carriers- Cobalt Schiff base, Vaska's complexes.
UNIT-3/ 18 Hours	METALLOENZYMES (REDOX AND NON REDOX) / METAL ION TRANSPORT AND STORAGE Hydrolases: Carboxypeptidase, carbonic anhydrase, alkaline phosphatase and other dinuclear phosphatases and hydrolases. Electron Transfer Proteins: Blue copper, Iron-Sulphur proteins – Ferridoxins&Rubredoxin, and cytochromes.Redoxenzymes : Cu, Zn SOD and Cytochrome P450, Manganese enzyme and xanthine oxidase. Haem enzymes- peroxidase and catalase.
UNIT-4/ 17 Hours	Nitrogenaseenzyme : Introduction, Types of nitrogen fixing microorganism,metal clusters in nitrogenase. Nitrogen fixation pathway.Transition metal complexes : Dinitrogen complexes. Biological redox reactions. Photosynthesis and chlorophyll.

UNIT-5/ 19 Hours	MEDICINAL BIO-INORGANIC CHEMISTRY/CHELATION THERAPY: Pt complexes in cancer therapy: Cisplatin and its mode of action, cytotoxic compounds of other metals. Gold containing drugs as antirheumatic agents and their mode of action, Lithium in psychopharmacological drugs. Metal complexes as probes of nucleic acid: Function of metal ions in genetic regulation, Metal DNA and RNA interactions – potential binding sites.
RECOMENDE READINGS:	1. Advanced Inorganic Chemistry, F.A. Cotton and G. W. Wilkinson. John Wiley &Sons, 5th Ed.1988. 2. Inorganic Chemistry, Principles of Structure and Reactivity, J. E. Huheey,E.A. Keiter 4th Ed.Harper Collins, 1993. 3. Bioinorganic chemistry, R. W. Hay, Halsted Press, 1984. 4. Principles of Bioinorganic Chemistry, S. J. Lippard and J.M. Berg, Panima Publishing Corporation, 2nd Ed., 1995. 5. Inorganic Chemistry of Biological Processes, M.N. Hughes, John Wiley &Sons, 2nd Edition, 1985.

M.Sc. CHEMISTRY FOURTH SEMESTER			
COURSE CODE: MSC 402		**COURSE TYPE: CCC**	
COURSE TITLE: **ENVIRONMENTAL CHEMISTRY**			
CREDIT: **THEORY:** **6**	**PRACTICAL:**	**HOURS:** **THEORY:** **90**	**PRACTICAL:** **00**
MARKS: **THEORY:** **70+30**	**PRACTICAL:**	**MARKS** **THEORY:**	**PRACTICAL:**

OBJECTIVE : To learn about Earth, Biosphere and Polution and its Control.

UNIT-1/ 17 Hours	ATMOSPHERIC CHEMISTRY The structure of the earth's atmosphere- chemistry of the lower and upper atmosphere.The chemistry of air pollution- oxides of nitrogen- hydrogen sulphide and oxides of sulphur- Aerosols – ozone depletion and consequences- dioxins burning plastics- other atmospheric chemicals- smog- radio activity and fallout- air pollution abatement.Green house effect- Global warming, oxides of carbon.
UNIT-2/ 20 Hours	**THE EARTH** The lithosphere- the chemical composition of earth- the structure and composition of inner earth- the mantle, and the crust.The exploitation of mineral resources and the abuse of earth – earth resources – changing the face of the land- the earth as a dump- recycle- earth resource conservation steps. The hydrosphere : The fresh water chemistry – the structure and properties of liquid water – lakes, rivers, ponds and stream – river chemistry, pollution and aeration – water additives- isotopes- mercury pollution. The chemical constituents of sea water- organic matter and suspended material- ocean dumping- oil pollution. The role of water in our total environment- the hydrologic cycle- snow and ice – nucleation and precipitation – the chemical composition of rain water- phase changes and isotopic fractionation.

UNIT-3/ 17 Hours	**THE BIOSPHERE** The structure of the biosphere, Man's perturbation of the biosphere – Man as a chemical factory – material use and waste – energy use and thermal pollution – ecological disruption – chemical sensation, hormonal imbalance and mutagens- internal pollution. Hydrosphere - lithosphere interaction: The structure of water at an interface – chemical composition of mineral water- weathering and the changing face of the land- the origin of the oceans- sedimentation and the deposition of materials from the hydrosphere – chemical exchange between sediments and the water column.
UNIT-4/ 19 Hours	**INTERACTIONS** Lithosphere- biosphere interaction: soil chemistry – the prospects of agriculture- agricultural pollution – pesticides and other persistent pollutants – the deposition of coal and petroleum – theories of origin of petroleum. Atmosphere – biosphere interaction and atmosphere – hydrosphere interaction: history of earth's atmosphere – the nitrogen cycle – the carbon cycle – air – sea interactions. Biosphere – hydrosphere interaction: The chemistry of water pollution – sewage treatment, primary, secondary- and tertiary – activated sledge – trickling filters- denitrification –biology and energy chain – reactor design theory – anaerobic digestion –eutrophication.
UNIT-5/ 17 Hours	**POLLUTION CONTROL** Pollution control in the following: Fertiliser, petroleum, pulp and paper, tanning, sugar, alcohol, electroplating and nuclear reactors. Analysis of pollutants: Sum, specific and group parameters BOD, COD, specific oxygen demand, DOC, DOCl, DOS, Fe, Cr, Cu, Pb, and Ni-So_2, NO_x, H2S, O_3 and CO.
RECOMENDE READINGS:	1. Chemistry of our environment R.A.Horne 2. Environmental chemistry A.K.De 3. Environmental chemical analysis Iain L, Marr and Malcom S. Cresser 4. Pollution control in process industries S.P.Mahajan.

M.Sc. CHEMISTRY FOURTH SEMESTER

COURSE CODE: MSC403 **COURSE TYPE: CCC**

COURSE TITLE:

SOLID STATE CHEMISTRY

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

OBJECTIVE : Study of Solid States.

UNIT-1/ 18 Hours	SOLID STATE REACTIONS Preparative Methods: Vapor phase transport, preparation of thin films - electrochemical methods,chemical vapour deposition; Crystal growth - Bridgman &Stokbarger methods, zone melting.Characterization of Solids: Crystal diffraction of X-rays, X-ray diffraction method; Powdermethod – principles and uses; Scattering of X-rays by crystals – systematic absences; Electrondiffraction; Neutron diffraction.
UNIT-2/ 20 Hours	POWDER COMPACT REACTIONS AND SOLID-STATE DEFECTS Diffusion Model: Parabolic rate law, Jander's rate equation, Kroger-Zeigler equation, Ginstling- Brounshtein rate equation. Stoichiometric Defects: Equilibrium concentration of point defects in crystals - Schottky defects, Frenkel defects; The photographic process - light sensitive crystals, mechanism of latent image formation, lithium iodide battery. Non-Stoichiometric Defects: Origin of non-stoichiometry, consequences of non-stoichiometry; Equilibria in non-stoichiometric solids, Colorcenters: F-centre, electron and hole centre; colour centre and information storage.
UNIT-3/ 16 Hours	ELECTRONIC PROPERTIES AND BAND THEORY Metals insulators and semiconductors,electronic structure of solids band theory,band structure of metals, insulators and semiconductors,doping semiconductors, p-n junction,

	super conductor.electrically conducting solids, organic charge transfer complex organic metals, new super conductors.
UNIT-4/ 18 Hours	SOLID ELECTROLYTES Typical Ionic Crystals: Alkali metal halides (vacancy conduction), silver chloride (interstitial conduction); Solid Electrolytes - β-alumina, silver iodide, halide and oxide ion conductors; Application of Solid Electrolytes. Fuel cells: electrochemical power generator (hydrogen-oxygen cell, Solid state Galvanic cell); Thermoelectric Effects: Seebeck effect; Hall Effect.
UNIT-5/ 18 Hours	MAGNETIC AND OPTICAL PROPERTIES OF SOLIDS Behaviour of substances in magnetic field; Effects of temperature (Curie & Curie-Weiss laws); Magnetic moments; Mechanism of ferro- and antiferromagnetic ordering – super exchange. Luminescence and phosphors; Configurational coordinate model, Antistoke phosphors, Lasers — ruby and neodymium. Conducting Organics: Organic conductors, preparation, mechanism of conduction in organic semiconductors, photoconductivity of polymers.
RECOMENDE READINGS:	1 A. R. West. *Solid State Chemistry and its Applications*, John Wiley (1987). 2. F. Gutmann& L.E. Lyons. *Organic Semiconductors*, John Wiley (1987). 3. N. B. Hannay, *Solid State Chemistry*, Prentice Hall of India (1979)

M.Sc. CHEMISTRY FOURTH SEMESTER

COURSE CODE: MSC D01 **COURSE TYPE: ECC/CB**

COURSE TITLE:

PHOTO INORGANIC CHEMISTRY

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

OBJECTIVE : To learn about Photochemistry, Excited States and Ligand field Photochemistry.

UNIT-1/ 18 Hours	BASICS OF PHOTOCHEMISTRY Absorption, excitation, photochemical laws, quantum yield, electronically excited states- life times-measurements of the times. Flash photolysis, stopped flow techniques. Energy dissipation by radiative and non-radiative processes, absorption spectra, Franck-Condon principle, photochemical stages- primary and secondary processes
UNIT-2/ 18 Hours	II PROPERTIES OF EXCITED STATES: Structure, dipole moment, acid-base strengths, reactivity. Photochemical calculation of rates of radiative processes. Bimolecular deactivation - quenching kinetics- Ill EXCITED STATES OF METAL COMPLEXES: Excited states of metal complexes: comparison with organic compounds, electronically excited states of metal complexes, charge-transfer spectra, charge transfer excitations, methods for obtaining charge-transfer spectra.
UNIT-3/ 18 Hours	LIGAND FIELD PHOTOCHEMISTRY Photosubstitution, photooxidation and photoreduction, lability and selectivity, zero vibrational levels of ground state and excited state, energy content of excited state, zero- zero spectroscopic energy, development of the equations for redox potentials of the excited states.

UNIT-4/ 20 Hours	REDOX REACTIONS BY EXCITED METAL COMPLEXES Energy transfer under conditions of weak interaction and strong interaction-exciplex formation; conditions of the excited states to be useful as redox reactants, excited electron transfer, metal complexes as attractive candidates (2,2'-bipyridine and 1,10- phenonthroline complexes), illustration of reducing and oxidising character of Ruthenium2+(bipyridal complex, comparision with Fe(bipy)s; role of spin-orbit coupling-life time of these complexes. Application of redox processes of electronically excited states for catalytic purposes, transformation of low energy reactants into high energy products, chemical energy into light
UNIT-5/ 16 Hours	Metal Complex Sensitizers Metal complex sensitizer, electron relay, metal colloid systems, semiconductor supported metal or oxide systems, water photolysis, nitrogen fixation and carbon dioxide reduction
RECOMENDE READINGS:	1. Concepts of Inorganic Photochemistry, A.W. Adamson and P.O. Fleischauer, Wiley. 2. Inorganic Photochemistry, J. Chern. Educ., vol. 60, no. 10, 1983. 3. Progress in Inorganic Chemistry, vol. 30, ed. S.J. Lippard, Wiley. 4. Coordination Chern. Revs., 1981, vol. 39, 121, 131; 1975, 15, 321; 1990,97,313. 5. Photochemistry of Coordination Compounds, V. Balzari and V. Carassiti, Academic Press. 6. Elements of Inorganic Photochemistry, G. J. Ferraudi, Wiley.

M.Sc. CHEMISTRY FOURTH SEMESTER

COURSE CODE: MSC D02 **COURSE TYPE: ECC/CB**

COURSE TITLE:

MATERIAL SCIENCE

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

OBJECTIVE: To gain knowledge about Material Science including Conductors and Semiconductors.

UNIT-1/ 18 Hours	**Classification of crystals** Seven crystal systems and fourteen Bravaislattices.Structure and bonding in solids- Cohesive force in crystals, van der waal'sinteractions,Ionic bonding, covalent bonding and hydrogen bonding in solids.Structure aspects os rock salt, rutile, fluorite, antifluorite, diamond, zinc blende, wurtzite,Crystobalite, spinels, inverse spinels and silicates.
UNIT-2/ 18 Hours	**Crystal geometry** Symmetry elements for solids (including glide planes and screw axis).Introduction to space groups with examples.Techniques of structure determination in solid state – X-ray diffraction, electron and neutron diffractions and electron microscopy – principle, instrumentation and applications; Calculation of structure factor.
UNIT-3/ 17 Hours	**Theories of metallic state** Free electron theory,(Brillouin) and Band models.Defects in crystals – Frenkel and Schotky defects, F-centres, effect of defects on the electrical, optical, magnetic, thermal and mechanical properties of crystals.Smart metals- binary and ternary – examples and applications.

UNIT-4/ 17 Hours	**Ionic conductors** Optimised ionic conductors-silver ion, copper ion, alumina and related electrolytes, alkali metalion, fluoride ion and proton conductors; super conductors – principle and applications.Models of ionic motion- simple hopping motion – cooperative motion models.Photo conducting materials – principle, examples and applications.
UNIT-5/ 20 Hours	**Organic semiconductors** Organic semiconductors – photo physical processes, thermal and photo generation of carriers;Aromatic hydrocarbons, phthalocynins- anthracene mechanisms; excitons and polarons.Change transfer complexes – characterization and their electrical properties.Conduction polymers- polyacetylenes, polyanilines and polyvinylidenes- preparation and Applications.Carbon Nano particles- fullerenes- preparation and potential applications. liquid crystals- classification- thermotropic and lyptropic- nemetic, smectic and cholestric and their applications.
RECOMENDE READINGS:	1. Materials science Raghavan 2. Materials Science Vol I and II by ManasChanda 3. Structural Inorganic chemistry A.F . Wells 4. Introduction to solid state physics McCrey et al. 5. Solid state chemistry and applications Antony West 6. Solid state chemistry Hannay 7. Chemistry of Nanomaterials,Vol.I&II, C.N.R. Rao, Muller and A. K. Cheetham, 8. Wiley VCH Verlag GmbH KGaA, 2002.