UNIVERSITY OF JAMMU

NOTIFICATION
(10/July/ ADP/35)

It is hereby notified for the information of all concerned that the Vice-Chancellor, in anticipation to the approval of the Academic Council, has been pleased to authorize adoption of the revised Syllabi and Courses of Study in the subject of Chemistry for B.Sc. I of Three Year (General) Degree Course and M.Sc. III semester of Master's Degree Programme for the examination to be held in the years as under along with %age of change:-

Chemistry

Adoption of the revised Syllabi of B.Sc. I & M.Sc. III Semester alongwith %age of Change

<table>
<thead>
<tr>
<th>Class</th>
<th>Part/Sem</th>
<th>For the Examinations to be held in the year</th>
<th>%age of Change</th>
</tr>
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<tbody>
<tr>
<td>B.Sc</td>
<td>I</td>
<td>2011, 2012 &amp; 2013</td>
<td>10% change</td>
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The alternative question papers are required to be set as per the University regulation given as under:-

i). If the change in the Syllabi and Courses of Study is less than 25%, no alternative Question paper will be set.

ii). if the change is 25% and above but below 50% alternative Question Paper be set for one year.

iii). If the change is 50% and above on whole scheme is changed, alternative Question Paper are set for two years.

Sd/-
(DR. P.S. PATHANIA)
REGISTRAR

F.Acd./XXVI/10/ 5232-16
Dated: 12-08-16

Copy for information and necessary action to:
Objective: The objective of the paper is to impart detailed knowledge in atomic structure, periodic profile, chemical bonding, chemistry of s & p block elements and chemistry of noble gas.

Unit-I
(a) Atomic structure
Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of $\Psi$ and $\Psi^2$, quantum numbers, radial and angular wave functions and probability distribution curves. Shapes of s, p, d orbital. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configuration of the elements (s, p d blocks only), effective nuclear charge.

(b) Periodic Properties
Atomic and ionic radii, ionization energy, electron affinity and electronegativity - definition, trends in periodic table and its applications in predicting and explaining the chemical behaviour.

Unit-II
Chemical Bonding—I
Covalent Bond-valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion (VSEPR) theory to NH$_3$, H$_2$O$, $SF_4$, ClF$_3$, ICl$_2$ and H$_2$O, MO theory, homonuclear and heteronuclear (CO and NO) diatomic molecules, multicenter bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

Unit-III
(a) Chemical Bonding—II
Ionic Solids-Ionic structures [AB-Type only], radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, Fajan's rule, polarizing power and polarisability of ions. Metallic bond-free electron, valence bond and band theories. Weak interactions-Hydrogen bonding, van der Waals forces.

(b) s-Block Elements
Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems.

Unit-IV
p-Block Elements—I
Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13-16, hydrides of boron-diborane and higher boranes, borazine, fullerenes, carbides, fluorocarbons.
Unit-V
(a) p-Block Elements-II
Silicates (Structural principle), tetrasulphur tetranitride, basic properties of Halogens, Interhalogens and polyhalides.
(b) Chemistry of Noble Gases
Chemical properties of the noble gases, Chemistry of Xenon, structure and bonding in Xenon compounds.

NOTE FOR PAPER SETTING
The question paper will contain two questions from each unit (total ten questions) and the candidates will be required to answer one question from each unit (total questions to be attempted will be five) i.e. there will be internal choice within each unit. The paper shall be 3 hrs. duration.

BOOKS RECOMMENDED
2. Concise Inorganic Chemistry, J.D. Lee, ELBS.
6. Inorganic Chemistry, A.G. Sharpe, ELBS.
Objective: To impart teaching in structure and bonding; organic reaction mechanism; stereochemistry of organic compounds; chemistry of saturated and unsaturated hydrocarbons including cyclic compounds and arenes; alkyl and aryl halides.

Unit-I
(a) Structure and Bonding
\[ \text{sp}^3, \text{sp}^2 \text{ and } \text{sp} \text{ hybridization of carbon compounds; bond lengths, bond angles and bond energy; localized and delocalized chemical bond; inductive and field effects, resonance and hyperconjugation.} \]

(b) Organic Reaction Mechanism
\[ \text{Homolytic and heterolytic bond breaking; formation of covalent bond; electrophilic and nucleophilic reagents; reaction intermediates-carbocations, carbanions, free radicals, carbenes, arenes and nitrenes (with examples); methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).} \]

Unit-II
Stereochecmistry of Organic Compounds
Newman projection, Sawhorse, Fischer projection and Flying-Wedge formulae, Optical isomerism – elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, meso compounds, resolution of racemic mixtures; relative and absolute configurations – D&L and R&S systems of nomenclature, sequence rules; geometrical isomerism – cis-trans isomerism, E&Z system of nomenclature, geometrical isomerism in oximes and alicyclic compounds; conformational isomerism – conformational analysis of ethane, n-butane, cyclohexane (chair and boat form), axial and equatorial bonds.

Unit-III
Alkanes, Cycloalkanes and Haloalkanes
IUPAC nomenclature of alkanes; classification of carbon atoms in alkanes, methods of formation of alkanes with special reference to Wurtz reaction, Kolbe’s reaction, Corey-House reaction and decarboxylation of carboxylic acids; physical properties and chemical reactions of alkanes; mechanism of free radical halogenation of alkanes.
Cycloalkanes – nomenclature, methods of formation, chemical reactions, Baeyer’s strain theory and its limitations; ring strain in small rings (cyclopropane and cyclobutane); theory of strainless rings; banana bonds.
Nomenclature and classification of Haloalkanes; methods of formation and chemical reactions of haloalkanes; mechanism of nucleophilic substitution reactions of alkyl halides – S_N^2 and S_N^1 reactions with energy profile diagrams.
Unit-IV 13 Hrs
Alkenes, Cycloalkenes, Dienes and Alkynes
Nomenclature of alkenes; methods of formation of alkenes – mechanism of dehydration of alcohols and dehydrohalogenation of alkyl halides; regioselectivity in alcohol dehydration, the Saytzeff rule, Hofmann elimination; physical properties and chemical reactions – mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff’s rule, hydroboration-oxidation, oxymercuration-reduction, epoxidation, ozonolysis, hydration, hydroxylation and oxidation with KMnO₄; polymerization and industrial applications of alkenes.
Methods of formation, chemical reactions and conformations of cycloalkenes.
Nomenclature and classification of dienes (isolated, conjugated and cumulative dienes); methods of formation and chemical reactions of butadiene including Diels-Alder reaction.
Nomenclature, methods of formation and chemical reactions of alkyynes (acidic nature of terminal alkyynes, electrophilic and nucleophilic addition reactions, hydroboration-oxidation, metal-ammonia reduction, oxidation and polymerization).

Unit-V 11 Hrs
Arenes, Aromaticity and Aryl halides
Nomenclature of substituted mononuclear aromatic hydrocarbons; structure of benzene – Kekule structure, stability and carbon-carbon bond lengths of benzene, resonance structure and molecular orbital structure; aromaticity – Huckel’s rule and its applications to polycyclic aromatics.
Mechanism of aromatic electrophilic substitution reactions – nitration halogenations, sulphonation and Friedel-Crafts reaction; role of σ– and π– complexes and energy profile diagrams; orientation in the aromatic electrophilic substitution reaction – effects of substituents on orientation and reactivity, ortho/para ratio.
Formation and reactions of aryl halides, nuclear and side chain reactions, the additional-elimination and the elimination-addition mechanisms of aromatic nucleophilic substitution reactions; relative reactivities of alkyl halides v/s aryl halides.

NOTE FOR PAPER SETTING
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BOOKS RECOMMENDED
Objective: The objective of the paper is to impart knowledge in Mathematical concepts & basic knowledge of Computers, States of matter, Chemical kinetics and Thermodynamics.

Unit-I 12 Hrs
(a) Mathematical Concepts
Differentiation of functions like $e^x$, $x^n$, $\sin x$, $\cos x$, $\log x$; maxima and minima, partial differentiation and Euler’s reciprocity relations, Integration of some useful/relevant functions; Factorials, Theorems of Probability.
(b) Computers
General introduction of Computers, different components of computers, hardware and software, input-output devices; binary numbers and arithmetic; introduction to computer languages, Programming, Operating systems.

Unit-II 12 Hrs
Gaseous State
Postulates of kinetic theory of gases, deviation from ideal behavior, van der waals equation of state.
Molecular Velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell’s distribution of molecular velocities, collision number, mean free path and collision diameter, Liquification of gases, Linde’s method & Claude’s method.
Critical Phenomena: PV isotherms of real gases, Continuity of states, the isotherms of van der waals equation, relationship between critical constants and van der waals constants, the law of corresponding states, reduced equation of state, Numericals.

Unit-III 12 Hrs
(a) Solid State
Definition of space lattice, unit cell.
X-rays diffraction by crystals, Derivation of Bragg equation, Determination of crystal structure of NaCl and KCl (Laue’s method and powder method).
(b) Liquid State
Intermolecular forces, structure of liquids (a qualitative description).
Structural differences between solids, liquids and gases.
Liquid crystals: Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholesteric phases. Thermography and seven segment cell.

Unit-IV 12 Hrs
Chemical Kinetics
Chemical kinetics and its scope, rate of reaction, factors influencing the rate of a reaction – concentration, temperature, pressure, solvent, light, catalyst and surface area.
Concentration dependence of rates, mathematical characteristics of simple chemical reactions – zero order, first order, second order, pseudo order, half life and mean life period. Determination of the order of reaction – differentiation method, method of integration, method of half life period and isolation method.

Radioactive decay as a first order phenomenon.

Theories of chemical kinetics: Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy.

Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects. Lindemann’s theory of unimolecular reactions & its limitations, Numericals.

Unit-V
Thermodynamics-I

Definition of thermodynamic terms: system, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work.

First law of thermodynamics: Statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule’s law. Joule-Thomson coefficient and inversion temperature. Calculation of \( w, q, dU \) & \( dH \) for the expansion of ideal gases under isothermal adiabatic conditions for reversible process.


NOTE FOR PAPER SETTING
The question paper will contain two questions from each unit (total ten questions) and the candidates will be required to answer one question from each unit (total questions to be attempted will be five) i.e. there will be internal choice within each unit. The paper shall be 3 hrs. duration.

BOOKS RECOMMENDED
5. Chemical Kinetics: Laidler, K.J.
LABORATORY COURSE

Inorganic Chemistry

Preparation of standard solutions. Dilution – 0.1M to 0.001M solutions (NaOH, Oxalic acid, KMnO₄, K₂Cr₂O₇)

Quantitative Analysis

Volumetric Analysis
(a) Determination of acetic acid in commercial vinegar using NaOH.
(b) Determination of alkali content-antacid tablet using HCl.
(c) Estimation of calcium content in Chalk as calcium oxalate by permanganometry.
(d) Estimation of ferrous and ferric by dichromate method.
(e) Estimation of hardness of water by EDTA.
(f) Estimation of copper using thiosulphate.

Organic Chemistry

1. The preliminary examination of physical and chemical characteristics (physical state, colour, odor and ignition tests), elemental analysis (nitrogen, sulphur, chlorine, bromine, iodine), solubility tests including acid-base reactions. Functional group tests of following classes of compounds
   - phenols, carboxylic acids
   - carbonyl compounds – ketones, aldehydes
   - carbohydrates
   - aromatic amines
   - amides, ureas and anilides
   - aromatic hydrocarbons and their halo- derivatives
2. Checking purity of organic solids by melting point/mixed melting point.
3. Aqueous separation of organic mixture of two compounds.
4. Purification of organic solids by
   (a) Sublimation (Naphthalene, camphor etc.)
   (b) Hot water (Benzoic acid, acetanilide etc.)

Physical Chemistry

Chemical Kinetics
1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
3. To compare the strength of HCl and H₂SO₄ by studying the Kinetics of hydrolysis of ethyl acetate.

Distribution Law
To study the distribution of benzoic acid between benzene and water.

Colloids
To prepare arsenious sulphide sol and compare the precipitating power of mono-, bi- and trivalent anions.

Viscosity, Surface Tension
1. To determine the percentage composition of a given mixture (non interacting systems) by viscosity method.
2. To determine the viscosity of amyl alcohol in water at different concentrations and calculate the excess viscosity of these solutions.
3. To determine the percentage composition of a given binary mixture by surface tension method (acetone & ethyl methyl Ketone).

Viva 5 marks

NOTE FOR PAPER SETTING
There shall be three exercises in the examination, one each from Inorganic, Organic and Physical Chemistry sections, of the marks indicated above against the each section.

BOOKS RECOMMENDED
1. Vogel’s Qualitative Inorganic Analysis, revised, Svehla, Orient Longman.
DETAILED SYLLABUS

Course No.: 500  
Title: Applications of Spectroscopy

Credits: 04  
Maximum Marks: 100

Duration of Examination: 3 hrs

a) Semester Examination: 80
b) Sessional Assessment: 20

Syllabus for the examinations to be held in Dec 2010, Dec 2011 and Dec 2012.

UNIT-I

a) Electron Spin Resonance Spectroscopy 8 hrs
Hyperfine coupling, spin polarization for atoms and transition metal ions, spin-orbit coupling and significance of g-tensors, application to transition metal complexes (having one unpaired electron) including biological systems and to inorganic free radicals such as PH₃, F₂ and BH₃.

b) Nuclear Magnetic Resonance of Paramagnetic Substances in Solution 7 hrs
The contact and pseudo contact shifts, factors affecting nuclear relaxation, some applications including biochemical system, an overview of NMR of metal nuclides with emphasis on ñ²Pt and ñ²Sn NMR.

UNIT-II

a) Vibrational Spectroscopy 5 hrs
Symmetry and shapes of AB₂, AB₃, AB₄, AB₅ and AB₆, mode of bonding of ambidentate ligands, ethylenediamine and diketonato complexes, application of resonance Raman spectroscopy particularly for the study of active sites of metalloproteins.

b) Mossbauer Spectroscopy 6 hrs
Basic principles, spectral parameters and spectrum display. Applications of the technique to the studies of (1) bonding and structures of Fe⁺² and Fe⁺³ compounds including those of intermediate spin, (2) Sn⁺² and Sn⁺⁴ compounds – nature of M-L bond, coordination number, structure and (3) detection of oxidation state and inequivalent MB atoms.

UNIT-III

a) Ultraviolet and Visible Spectroscopy 3 hrs
Various electronic transitions (185-800 nm), Beer-Lambert law, effect of solvent on electronic transitions, ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes. Fieser-Woodward rules for conjugated dienes and carbonyl compounds, ultraviolet spectra of aromatic and heterocyclic compounds. Steric effect in biphenyls.

b) Infrared Spectroscopy 5 hrs
Instrumentation and sample handling. Characteristic vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, phenols and amines. Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides, acids, anhydrides, lactones, lactams and conjugated carbonyl compounds). Effect of hydrogen bonding and solvent effect on vibrational frequencies, overtones, combination bands and Fermi resonance FTIR. IR of gaseous, solids and polymeric materials.

c) Optical Rotatory Dispersion (ORD) and Circular Dichorism (CD) 3 hrs
Definition, deduction of absolute configuration, octant rule for ketones.
UNIT-IV
Nuclear Magnetic Resonance Spectroscopy
General introduction and definition, chemical shift, spin-spin interaction, shielding mechanism, mechanism of measurement, chemical shift values and correlation for protons bonded to carbon (aliphatic, olefinic, aldehydic and aromatic) and other nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides and mercapto), chemical exchange, effect of deuteration, complex spin-spin interaction between two, three, four and five nuclei (first order spectra), virtual coupling. Spectrochemistry, hindered rotation Karplus curve-variation of coupling constant with dihedral angle. Simplification of complex spectra nuclear magnetic double resonance, contact shift reagents, solvent effects, Fourier transform techniques, nuclear Overhauser effect (NOE). Resonance of other nuclei – F, P.

Unit-V
a) Carbon-13 NMR Spectroscopy
general considerations, chemical shift (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carbonyl carbon), coupling constants.
Two dimension NMR spectroscopy – COSY, NOESY, DEPT, INEPT, APT and INADEQUATE techniques.

b) Mass Spectroscopy
Introduction, ion production – El, CI, FD and FAB, factors affecting fragmentation of organic compounds, common functional groups, molecular ion peak, metastable peak, McLafferty rearrangement. Nitrogen rule. High resolution mass spectroscopy. Examples of mass spectral fragmentation or organic compounds with respect to their structure determination.

NOTE FOR PAPER SETTING
The question paper will contain two questions from each unit (total ten questions) and the candidates will be required to answer one question from each unit (total five questions) i.e. there will be internal choice within each unit.

BOOKS RECOMMENDED
DETAILED SYLLABUS

Course No.: 501
Credits: 04
Duration of Examination: 3 hrs

Title: Solid State Chemistry
Maximum Marks: 100
a) Semester Examination: 80
b) Sessional Assessment: 20

Syllabus for the examinations to be held in May 2010, May 2011 and May 2012.

UNIT-I
a) Solid State Reactions
   - General principles, Preparation of materials in the solid state: precursor, ceramic, sealed tube, hydrothermal and high pressure methods; kinetics of solid state reactions; tarnishing reactions.

b) Crystal Defects and Non-stoichiometry
   - Perfect and imperfect crystals, intrinsic and extrinsic defects – point defects, line and place defects, vacancies- Schottky and Frenkel defects, Thermodynamics of Schottky and Frankel defect formation, colour centres, non-stoichiometry and defects, ionization of defects.

UNIT-II
Structure of Solids
   - Crystal systems, Bravais lattice, symmetry: point symmetry and point groups. Representation of point groups – space symmetry, space groups for the various systems. Space groups and crystal structures.

UNIT-III
Electronic Properties and Band Theory
   - Metals, insulators and semiconductors, electronic structure of solids; chemical and physical approaches- band theory, band structure of metals, insulators and semiconductors, intrinsic and extrinsic semiconductors, doping of semiconductors, p-n junctions, superconductors.

UNIT-IV
Optical and Magnetic Properties

_UNIT-V
Organic Solids
   - Topochemical control of solid state organic reactions, electrically conducting solids, new super conductors.

Electric Properties
   - Thermolectric effects: Thomson effect, Peltier effect, Seebeck effect; Thermocouples; Hall effect; Dielectric materials, Ferro electricity, Pyroelectricity, Piezoelectricity. Applications of Ferro, Piezo and Pyroelectrics.

NOTE FOR PAPER SETTING
The question paper will contain two questions from each unit (total ten questions) and the candidates will be required to answer one question from each unit (total five questions) i.e. there will be internal choice within each unit.

BOOKS RECOMMENDED
7. Solid State Chemistry, H.V. Keer.
DETAILED SYLLABUS

Course No.: 502
Credits: 04
Duration of Examination: 3 hrs

Title: Bio-Organic & Medicinal Chemistry
Maximum Marks: 100
a) Semester Examination: 80
b) Sessional Assessment: 20

Syllabus for the examinations to be held in May 2010, May 2011 and May 2012.

UNIT-I
Enzymes & kinds and mechanism of enzymatic reactions
12 hrs
Introduction and historical perspectives, chemical and biological catalysis, remarkable properties of enzymes like catalytic power, specialization and regulation. Nomenclature and classification. Fischer’s lock and key and Koshland’s induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labelling and enzyme modification by site-directed mutagenesis.
Orientation and steric effect in enzyme catalysis, acid base catalysis, covalent catalysis, strain or distortion.
Nucleophilic displacement on a phosphorus atom, multiple displacement reactions and coupling of ATP cleavage to endorgonic processes. β-cleavage and condensation. Enzyme catalyzed carboxylation and decarboxylation.

UNIT-II
Chemistry of Vitamins B-Complex and Coenzymes
13 hrs

UNIT-III
Drug-design
10 hrs
Introduction, concept of Lead compounds, Factors governing drug design and rational approach. Drug design through method of variations, disjunction and conjunction. Bioisoteric replacement, rigid analogs, homologation of alkyl chains, changes in ring size and ring position isomers, alteration of spectrochemistry, fragments of lead molecules.

UNIT-IV
Synthesis and mode of following classes of drugs:
12 hrs
1. Cardiovascular drugs: Antihypertensive and hypotensive drugs:
   - Hydralazine (Apresoline hydrochloride), Methyldopa (Aldomet), Procainamide (Pronestyl); Antisympathetic drugs- Propanolol (Indral), Varapamil (Isoptin) and Prenylaminelactate (Synadrin).
2. Antiparkinsonian Agents: Biperiden hydrochloride (Akineton hydrochloride), Ethopropazine hydrochloride, Levodopa (Bendopa).
3. Anticancer drugs: Adriamycin, Methotrexate, Tomoxifen.
4. Antihistaminic drugs: Citrizine, (Promethazine hydrochloride) and Chloropheniramine meleate (Alerrmine).
5. Antimalarials: Chloroquine phosphate (Resochin) and Mepacrine hydrochloride (Quinacrine).
Unit-V 13 hrs
(a) Antibiotics: Introduction, classification, isolation and chemistry of Penicillin, Cephalosporin C, Chloramphenicol and tetracycline (oxy tetracycline).
(b) Vitamins: Occurrence, Chemistry functions and mechanism of action of Ascorbic acid, α-Tocopherol and Vitamin K₁ & K₂.

NOTE FOR PAPER SETTING
The question paper will contain two questions from each unit (total ten questions) and the candidates will be required to answer one question from each unit (total five questions) i.e. there will be internal choice within each unit.

BOOKS RECOMMENDED
DETAILED SYLLABUS

Course No: 503
Credits: 4
Duration of Examination: 3 hrs

Title: Environmental Chemistry
Maxium Marks: 100
a) Semester Examination: 80
b) Sessional Assessment: 20

Syllabus for the examinations to be held in Dec. 2010, 2011 & 2012.

Unit - I
a) Environment: 8 Hrs

b) Soils: 6 Hrs
Composition of soil, micro and macro nutrients, NPK in soil, Acid-base and ion exchange reactions in soils, Soil pollution due to fertilizers, pesticides, plastics and metals.

Unit - II
Hydrosphere 12 Hrs
Chemical composition of water bodies – lakes, streams and rivers; Hydrological cycle; Aquatic pollution due to inorganic, organic, pesticide, industrial sewage, detergent, oil pollutants; Water quality parameter and their analytical methods: Dissolved oxygen, Biochemical oxygen demand, Chemical oxygen demands, contents of chloride and chlorine demand and solids; Purification and treatment of water and criteria of water quality.

Unit - III
Industrial Pollution 12 Hrs
a) Environmental implications and abetment of Cement industry, sugar mill, distillery industry, paper and pulp mill, thermal power plant and polymer/plastic industry.
b) Disposal of wastes and their management.

Continued
Unit - IV
Atmosphere
Chemical composition of atmosphere – particles, ions and radicals and their formation. Chemical and photochemical reactions in atmosphere, smog formation, oxides of N, C, S, O and their effects and analytical methods, Chlorofluoro hydrocarbons, Green house effect, acid rains.

Unit - V
Environmental Toxicology
a) Hazardous waste: Introduction, origin, transport, effects and fates; Biodegradation and principles of decomposition; Chemical treatment of hazardous wastes.
b) Bhopal gas tragedy, Chernobyl, Three Mile Island and Minamata disasters.

NOTE FOR PAPER SETTING
The question paper will contain two questions from each unit (total ten questions) and the candidates will be required to answer one questions from each unit (total five questions) i.e., there will be an internal choice with in each unit.

Books Recommended
1. Environmental Chemistry, S. E. Manahan, Lewis Publishers
2. Environmental Chemistry, Sharma & Kaur, Krishna Publishers
DETAILED SYLLABUS

Course No.: 504
Credits: 08
Duration of Examination: 14 hrs

Title: Practical Course
Maximum Marks: 200
a) Semester Examination: 100
   (including 20 in viva-voce)
b) Sessional Assessment: 100

Syllabus for the examinations to be held in May 2010, May 2011 and May 2012.

INORGANIC CHEMISTRY 90 hrs (26 marks)

Preparation
Preparation of selective inorganic compounds and their study by IR, electronic spectra, Mossbauer, ESR and magnetic susceptibility measurement. Handling of air and moisture sensitive compounds involving vacuum lines.
Selection can be made from the following:
3. Atomic absorption analysis of Mg and Ca.
4. Trialkoxyboranes-Preparation, IR and NMR spectra.
5. PbCl₂ Dichlorophenylborane-synthesis in vacuum line.
7. Relative stability of Tin(IV) and Pb(IV). Preparation of ammonium hexachlorostannate (NH₄)₂SnCl₆, ammonium hexachloroplumbate (NH₄)₂PbCl₆.
8. Hexa-(4-nitrophenoxo) cyclotriphosphazene.
10. Sodium tetraphionate Na₂S₄O₆.

Flame Photometric Determinations
a) Sodium and potassium when present together.
b) Lithium/calcium/barium/strontium.
c) Cadmium and magnesium in tap water.
d) Zinc and magnesium.
e) Thin-layer chromatography-separation of nickel.
f) Separation and identification of the sugars present in the given mixture of glucose, fructose and sucrose by paper chromatography and determination of Rf values.

ORGANIC CHEMISTRY 90 hrs (27 marks)

Qualitative Analysis
Separation, purification and identification of the components of a mixture of three organic compounds (three solids or two liquids and one solid, two solids and one liquid), using TLC for checking the purity of the separated compounds, chemical analysis, IR, PMR and mass spectral data.

Paper Chromatography
Separation and identification of the sugars present in the given mixture of glucose, fructose and sucrose by paper chromatography and determination of Rf values.

Spectroscopy
Identification of organic compounds by the analysis of their spectral data (UV, IR, PMR, CMR and MS).

PHYSICAL CHEMISTRY 90 hrs (27 marks)

Physical Chemistry
Number of hours for each experiment – 3-4 hours.

A list of experiments under different headings are given below. Typical experiments are to be selected from each type.

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

Spectroscopy
i) Determination of pKa of an indicator (e.g. methyl red) in (a) aqueous and (b) micellar media.
ii) Determination of stoichiometry and stability constant of inorganic (e.g. amine-iodine) complexes.
iii) Characterization of the complexes by electronic and IR spectral data.

Conductivity
Measurement of the conductivity of crystals as function of temperature, estimation of band gap.