B.A./B.Sc. (Semester System) *(12+3 System of Education)*
(Faculty of Sciences)

CHEMISTRY
INORGANIC CHEMISTRY–V
(THEORY)

Time: 3 Hrs Marks: 35

45 Hrs. (3 Hrs./week)

The question paper shall consist of two parts as detailed below:-

Part-A :- (Compulsory)

It shall consist of 8 very short answer type questions (Q. Nos. 1 to 8) from the entire syllabus and the maximum length of each question may not exceed 1/3rd the page. Each question will be carrying one mark. **8 x 1 = 8 Marks**

Part-B :-

It shall consist of three sections (Section 1, II & III). It shall consist of 9 questions (Q. Nos. 9 to 17) from the entire syllabus. Each question will consist of 3 questions from each Unit of syllabus. The maximum length of each question may not exceed 5 pages. The candidate will attempt two questions from each section. Each question will be carrying 4½ marks.

6 x 4½ = 27 Marks

JULY-SEPTEMBER 2014

1. Metal-ligand Bonding in Transition Metal Complexes (10 Hrs)

Limitations of valence bond theory, an elementary idea of crystal-field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters.

2. Magnetic Properties of Transition Metal Complexes (5 Hrs)

Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of μs and μeff values, orbital contribution to magnetic moments, application of magnetic moment data for characterization of 3d-metal complexes.

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3. Thermodynamic and Kinetic Aspects of Metal Complexes (5 Hrs.)

A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square

OCTOBER-NOVEMBER 2014

4. Electronic Spectra of Transition Metal Complexes (10 Hrs)

Spectroscopic ground states for d^1-d^{10} electronic configurations.

Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states.

Section–III

5. Organometallic Compounds: (15 Hrs)

Definition, nomenclature and classification of organometallic compounds. EAN rule, Preparation, properties, and applications of alkyls aryls of lithium and aluminium, Bonding in metal-ethylenic complexes, Mechanism of homogeneous hydrogenation reactions.

B.A./B.Sc. (Semester System) *(12+3 System of Education)*
(Faculty of Sciences)

SEMESTER–V
CHEMISTRY
PHYSICAL CHEMISTRY–III
(THEORY)

Time: 3 Hrs **45 Hrs. (3 Hrs./week)**
Marks: 35

The question paper shall consist of two parts as detailed below:-

Part-A :- (Compulsory)
It shall consist of 8 very short answer type questions (Q. Nos. 1 to 8) from the entire syllabus and the maximum length of each question may not exceed 1/3rd the page. Each question will be carrying one mark. **8 X 1 = 8 marks**

Part-B :-
It shall consist of three sections (Section 1, II & III). It shall consist of 9 questions (Q. Nos. 9 to 17) from the entire syllabus. Each question will consist of 3 questions from each Unit of syllabus. The maximum length of each question may not exceed 5 pages. The candidate will attempt two questions from each section. Each question will be carrying 4½ marks.
6 X 4½ = 27 Marks

JULY-SEPTEMBER 2014

1. Electrochemistry-I (7 hrs.)
Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution. Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method. Applications of conductivity measurements: determination of degree of dissociation, determination of Ka of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

2. Electrochemistry – II (8 hrs.)
Types of reversible electrodes-gas metal ion, metal ion, metal insolblue salt-anion and redox electrodes. Electrode reactions. Nernst equation, derivation of cell E.M.F. and Single electrode potential, standard hydrogen electrode, reference electrodes, standard electrode potential, sign conventions, electrochemical series and its significance. Electrolytic and Galvanic cellsreversible and irreverisible cells, conventional representation of electrochemi cells.
EMF of a cell and its measurements. Computation of cell. EMF, Calculation of thermodynamic quantities of cell reactions (ΔG ΔH and K), polarization, over potential and hydrogen overvoltage. Concentration cells with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.
Definition of pH and pKa, determination of pH using hydrogen, quinhydrone and glass

electrodes, by potentiometric methods. Buffers-mechanism of buffer action, HendersonS equation, Hydrolysis of salts. Corrosion-types, theories and methods of combating it.

3. Nuclear Chemistry (15 Hrs.)
Introduction: Radioactivity, Nuclear Structure, Size of Nucleus, Mass Defects and Binding Energy, Nuclear Stability, Nuclear Forces, Nuclear Spin and Moments of Nuclei, Nuclear Models, Nuclear Decay Processes, The Laws of Radioactive Decay, Soddy-Fajans Group Displacement Law, Rate of Nuclear Decay and Half Life Time (Kinetics of Radioactive Decay), Induced Nuclear Reactions, Types of Nuclear Processes, High Energy Nuclear Reactions, Nuclear Reaction Cross-Section, Artificial radioactivity, Detection and Measurement of Radioactivity, Nuclear Fission, Nuclear Fusion, Applications of Radioactivity.

OCTOBER- NOVEMBER 2014

4. Spectroscopy (15 Hrs.)
Introduction: Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.

5. Rotational Spectrum
Diatomic molecules. Energy levels of a rigid rotor (semiclassical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect.

6. Vibrational Spectrum

Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

Raman Spectrum: Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.

7. Electronic Spectrum

Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck-Condon principle.

Qualitative description of s, p, and n M.O., their energy levels and the respective transitions

B.A./B.Sc. (Semester System) *(12+3 System of Education)*
(Faculty of Sciences)

SEMESTER–V
CHEMISTRY
(PRACTICAL)

Duration: 3½ Hrs. **Marks: 30**
6 Period/week

JULY –SEPTEMBER 2014

(I) Synthesis and Analysis
(a) Preparation of Sodium trioxalatoferrate (III)
(b) Preparation of Ni-DMG Complex
(c) Preparation of Copper tetrammine complex
(d) Preparation of cis-bisoxalatodiaquachromate (III) ion
(II) Physical Chemistry
(a) Conductometric Titrations
(i) Determine the end point of the following titrations by the conductometric methods.
Strong acid-Strong base
Strong acid-Weak base
Weak acid-Strong base
Weak acid-Weak base
(ii) Determine the composition of a mixture of acetic acid and the hydrochloric acid by conductometric titration.

OCTOBER-NOVEMBER 2014

(b) (i) Molecular Weight Determination of acetanilide, napthalane, using camphor as solvent **(Rast's methods).**
(ii) To determine the molecular weight of a polymer by viscosity measurements.
(c) Adsorption (i) To study the adsorption of acetic acid oxalic/acid from aqueous solutions by charcoal.
(d) Phase Equilibria to determine the distribution coefficient of iodine between CCI_4 and water.
(e) Refractometry
(i) Determination of refractive index of a liquid by Abbe refractometer, and hence the specific and molar refraction.
(ii) To determine the composition of unknown mixture of two liquids by refractive index measurements.
Practical Examination
1) Inorganic Synthesis 10
2) Physical experiment 13
3) Viva- Voce 04
4) Note Book 03

B.A./B.Sc. (Semester System) *(12+3 System of Education)*
(Faculty of Sciences)

SEMESTER–VI
CHEMISTRY
ORGANIC CHEMISTRY– IV
(THEORY)

Time: 3 Hrs **Marks: 35**
45 Hrs. (3 Hrs./week)

The question paper shall consist of two parts as detailed below:-
Part–A :- (Compulsory)
It shall consist of 8 very short answer type questions (Q. Nos. 1 to 8) from the entire syllabus and the maximum length of each question may not exceed 1/3rd the page. Each question will be carrying one mark. **8 X 1 = 8 Marks**
Part–B :-
It shall consist of three sections (Section 1, II & III). It shall consist of 9 questions (Q. Nos. 9 to 17) from the entire syllabus. Each question will consist of 3 questions from each Unit of syllabus. The maximum length of each question may not exceed 5 pages. The candidate will attempt two questions from each section. Each question will be carrying 4½ marks.
6 X 4½ = 27 Marks

JANUARY-FEBRUARY 2015

1. Spectroscopy (15 hrs.)
Nuclear Magnetic Resonance (NMR) spectroscopy.
Proton Magnetic Resonance (1H NMR) spectroscopy,
nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone.

2. Electromagnetic Spectrum: Absorption Spectroscopy
Ultraviolet (U.V.) absorption spectroscopy introduction- (Beer-Lambert law), molar absorptivity, analysis of UVspectra, types of electronic transitions effect of conjugation. Concept of chromophores and auxochrome, Bathochrome, hypsochrome, hyperchrome, hypochromic shifts-UV spectra of conjugated compounds, Infrared (IR) Absorption spectroscopy-introduction, Hooke's law, Selection rules, intensity and IR bands, measurement of IR spectrum time characteristic absorption of various fundamental band interpretation of IR spectra of simple organic compounds.

3. Problems based on spectroscopy (4 Hrs.)
Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.

4. Organosulphur Compounds (3 Hrs.)
Nomenclature, structural features, Methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine.

5. Synthetic Polymers (4 Hrs.)
Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers.
Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers.

MARCH-APRIL 2015

6. Organic Synthesis *via* Enolates (4 Hrs.)
Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate.
Alkylation of 1,3-dithianes. Alkylation and acylation of enamines.

7. Carbohydrates (8 Hrs.)
Classification and nomenclature. Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters. Determination of ring size of monosaccharides. Cyclic structure of D(+)-glucose. Mechanism of mutarotation.

Structures of ribose and deoxyribose
An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

8. Amino Acids, Peptides, Proteins and Nucleic Acids (7 Hrs.)
Classification, structure and stereochemistry of amino acids. Acid-base behaviour, isoelectric point and electrophoresis. Preparation and reactions of α-amino acids.
Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Structures of peptides and proteins. Levels of protein structure. Protein denaturation/renaturation.
Nucleic acids : Introduction. Constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.

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(Faculty of Sciences)

SEMESTER–VI
CHEMISTRY
PHYSICAL CHEMISTRY–IV
(THEORY)

Time: 3 Hrs **Marks: 35**
45 Hrs. (3 Hrs./week)

The question paper shall consist of two parts as detailed below:-
Part–A :- (Compulsory)
It shall consist of 8 very short answer type questions (Q. Nos. 1 to 8) from the entire syllabus and the maximum length of each question may not exceed 1/3rd the page. Each question will be carrying one mark. **8 X 1 = 8 Marks**
Part–B :-
It shall consist of three sections (Section 1, II & III). It shall consist of 9 questions (Q. Nos. 9 to 17) from the entire syllabus. Each question will consist of 3 questions from each Unit of syllabus. The maximum length of each question may not exceed 5 pages. The candidate will attempt two questions from each section. Each question will be carrying 4½ marks.
6 X 4½ = 27 Marks

JANUARY-FEBRUARY 2015

1. Quantum Mechanics-I (15 hrs.)
Black-body radiation, Planck's radiation law, Photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects, Compton effect.
de Broglie hypothesis, Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box, quantization of energy levels, extension to two and three dimensional boxes, degeneracy.

2. Quantum Mechanics-II (15 hrs.)
Simple harmonic oscillator model of vibrational motion, setting up Schrodinger equation and discussion of solution and wave functions. Rigid rotator model of rotation of diatomic molecules transformation to spherical polar coordinates spherical harmonics and their discussion. Qualitative investigation H-atom, setting up Schrodinger equation, radial and angular part, radial distribution functions of 1s, 2s, 2p, 3s, 3p and 3d.

MARCH-APRIL 2015

3. Solid State (8 Hrs.)

Definition of space lattice and unit cell, Law of crystallography- (i) Law of constancy of interfacial angles, (ii) Law of rationality of indices, (iii) Symmetry elements in crystals. X-ray diffraction by crystals. Derivation of Bragg's Law in Reciprocal space. Determination of crystal structure of NaCl, KCl by use of Powder method; Laue's method.

4. Photochemistry (7 Hrs.)

Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus–Drapper law, Stark–Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of flourescence, phosphorescence, non–radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions–energy transfer processes (simple examples).

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SEMESTER–VI
CHEMISTRY
(PRACTICAL)

Duration 3½ Hrs. 6 Period **M. Marks: 30**

JANUARY-FEBRUARY 2015

Synthesis of Organic Compounds
Preparation of p-nitroacetanilide
Preparation of p-bromoacetanilide
Green Chemistry Experiment: Preparation of benzilic acid from Benzyl-using green approach.
Preparation of Methyl Orange, Methyl Red
Preparation of benzilic acid from benzyl-using green approach

MARCH-APRIL 2015

Organic Chemistry Laboratory Techniques
Column Chromatography
Separation of o & p nitrophenol
Separation of Leaf pigments from Spinnach leaves
Separation of o & p nitro aniline
Separation of dyes.

Practical Examination
1) Column Chromatography 07
2) Organic Synthesis 16
3) Viva-Voce 04
4) Note Book 03