

**SARDAR PATEL UNIVERSITY SYLLABUS OF T. Y. B. Sc.
ORGANIC CHEMISTRY**

(Effective from June 2008)

C - 301

UNIT : I

SPECTROSCOPY [14 Marks]

- 17.1 Determination of structure : Spectroscopic methods.**
- 17.3 The electromagnetic spectrum.**
- 17.4 The infrared spectrum (figure 17.2 a, b and c)**
- 17.5 Infrared spectra of hydrocarbons.**
- 17.6 Infrared spectra of alcohols. (Figure 17.3)**
- 17.7 Infrared spectra of ethers (figure 17.5 a and b).**
- 17.8 The ultraviolet spectrum**
- 17.9 The nuclear magnetic resonance (NMR) spectrum.**
- 17.10 NMR. Number of signals.**
- 17.11 NMR positions of signals. Chemical shift (Fig. 17.10).**
- 17.12 NMR peak area and proton counting (Fig. 17.11).**
- 17.13 NMR Splitting of signals. Spin-spin coupling. (Figs. 17.13, 17.18 to 17.20)**
- 17.14 NMR coupling constant.**
- 17.17 Carbon - 13 NMR (CMR) spectroscopy**
- 17.18 CMR Splitting**
- 17.19 CMR Chemical shift (Fig. 17.29)**
- 17.20 NMR and CMR spectra of hydrocarbons**
- 17.21 NMR and CMR spectra of alkyl halides**
- 17.22 NMR and CMR spectra of alcohols and ethers.**
- 18.23 Spectroscopic analysis of aldehydes and ketones.**
- 19.22 Spectroscopic analysis of Carboxylic acids. (Fig. 19.5)**
- 23.21 Spectroscopic analysis of amines and substituted amides.**
- 20.25 Spectroscopic analysis of Carboxylic acid derivatives. (Fig. 20.2).**

Problems : 17.3, 17.4, 17.5, 17.8, 17.9, 17.12, 17.13, 17.15, 17.16, 17.19 (i) (a to d, f), 17.20,

17.26, 17.29.

Chapter 17 : Prob. 1, 2, 3, 5, 16, 19, 21, 22, 23, 24, 25, 26 and 27.

Chapter 17 : Prob. 16 and 20 (From 4th edition page 725.

Chapter 18 : Prob. 32, 33

Chapter 19 : Prob. 25

Chapter 20 : Prob. 19(a), 21, 22, 23, 24, 25 and 26.

Chapter 23 : Prob. 30, 31, 32.

Chapter 24 : Prob. 33

N. B. The weightage of theory portion and problem is 4 marks and 10 marks respectively.

Ref. Book. : Organic Chemistry by Morrison and Boyd, 6th ed.

UNIT : II
REACTION MECHANISM [13 Marks]

5.16 Carbenes

5.9.4 Birch reduction (Applicable to aromatics, acetylene, allens and allylic system).

5.14 Hofmann – Loeffler reaction

8.16 Stevens rearrangement

11.1.2 Favorskii rearrangement (From S. M. Mukherji and S. P. Singh page 273).

1.1. Benzidine rearrangement (From Reaction mechanism in organic chem. By S. M. Mukherji and S. P. Singh).

8.14 Benzilic acid rearrangement

8.18 Sommet rearrangement

7.2d Stobbe condensation (From Principles of Org. synthesis, by ROC Norman p. 233-235)

5.9 Darzens reaction

8.9 Arndt-Eistert reaction (Advance Organic Chemistry by Jerry march, 3rd ed. Page 974 to 976)

8.7 Curtius rearrangement

10.2.3 Curtius–Schmidt rearrangement .

5.1 Baeyer Villiger oxidation

5.8 Claisen Ester condensation

8.2 Pinacol-Pinacolone rearrangement.

8.19 Grovenstein-Zimmerman rearrangement.

10.2.1 Wolff rearrangement.(From S. M. Mukherji and S. P. Singh).

Beckmann rearrangement (From Org. Chem.,Vol II, by I.L. Finar page no. 249 to 253).

Ref. Book (1) Reaⁿ mechanism in Organic Chemistry by S. M. Mukherji. (2) Other topics from Organic reaⁿ mechanism by R.K. Bansal, 3rd ed.

UNIT – III
CARBOHYDRATES - I [13 Marks]

34.1 Introduction of monosaccharides

34.2 Defination and Classification

34.3 (+)-Glucose : an aldohexose

34.4 (-)-Fructose : a 2-ketohexose

34.5 Stereo isomers of (+)-glucose.

- 34.6 Oxidation Effect of alkali
- 34.7 Osazone formation Epimers
- 34.8 Kiliani–Fischer synthesis
- 34.9 Ruff degradation
- 34.10 Conversion of an aldose into its epimers
- 34.11 The Fischer proof
- 34.12 Configuration of aldose
- 34.13 Optical families D and L
- 34.14 Tartaric acid
- 34.15 Families of aldose. Absolute configuration
- 34.16 Cyclic structure of D-(+)-glucose.
- 34.17 Configuration about C-1.
- 34.18 Methylation
- 34.19 Determination of ring size
- 34.20 Conformation

CARBOHYDRATE – II

Disaccharides and Polysaccharides

- 35.1 Disaccharides
 - 35.2 (+)-Maltose
 - 35.3 (+)-Cellobiose
 - 35.4 (+)-Lactose
 - 35.5 (+)-Sucrose
 - 35.6 Polysaccharides
 - 35.8 Structure of amylose. End group analysis.
 - 35.9 Structure of amylopectin
 - 35.10 Cyclodaxtrine
 - 35.11 Structure of cellulose
 - 35.12 Reaction of cellulose
- *Synthesis of ascorbic acid, Ch. 7, page 318-319 from Org. Chem., Vol II, by I.L. Finar.
- Problems : 34.17, 34.20, 2(d,f,g,h,i), 3(c),
- Ref. Book : Organic Chemistry by Morrison and Boyd, 6th ed.
- Prob. : Q.10 and Q.11 (Page 586) and multiple choice questions (Page 587, from Text book of organic chemistry by Arun Balh and B.S. Bahl. 16^{ed}
- N.B.: The multiple choice questions can also ask as fill up the blank.

UNIT – IV

Orbital Symmetry and Pericyclic reactions [13 Marks]

- Introduction to pericyclic reaction
- Characteristics of pericyclic reaction
- 28.1 Molecular orbital theory
- 28.2 Wave equations, Phase
- 28.3 Molecular orbitals, LCAO method.
- 28.4 Bonding and anti-bonding orbitals
- 28.5 Electronics configuration of some molecules.

- 28.6 Aromatic character. The Huckel $4n+2$ rule
 28.7 Orbital symmetry and the chemical reaction
 28.8 Electrocyclic reaction
 28.9 Cycloaddition reaction
 28.10 Sigmatropic reaction
 14.4.3 Cope and Claisen rearrangement (From Reaⁿ mechanism in Organic Chemistry by S.M. Mukherji and S.P. Singh P. 370. Also refer topics 11.15.1 and 11.16 from Organic Reaction Mechanism by R.K. Bansal)
 Problems : 28.6 28.7 (a to f), 3 (b and d), 4,5 and 14.

UNIT - V

HETEROCYCLIC COMPOUNDS [13 Marks]

- 30.1 Heterocyclic systems
 30.2 Structure of Pyrrole, furan and thiophene
 30.3 Source of Pyrrole, furan and thiophene
 30.4 Electrophilic substitution in Pyrrole, furan and thiophene. Reactivity and orientation
 30.5 Saturated five - membered heterocycles
 30.6 Structure of pyridine
 30.7 Sources of pyridine compounds
 30.8 Reactions of pyridine
 30.9 Electrophilic substitution in pyridine
 30.10 Nucleophilic substitution in pyridine
 30.11 Basicity of pyridine
 30.12 Reduction of pyridine
 35.13 Quinoline. The Skraup synthesis
 35.14 Isoquinoline. The Bischler-Napieralski synthesis
 Structure and synthesis of Uric acid and Purine
 (based on Medicus and Fitting formula and proof of Medicus formula based on Behrend and Roosen, Baeyer, and Traube's syntheses from page 797-802, ch-16 of I. L. Final Vol. II, 5th ed.)
 Problems : 30.1, 30.2, 30.7, 30.10, 30.12, 30.14, 30.16, 30.17, 30.18, 7(a, b, d, e, f) 8, 11, 14, 15.
 Ref. Book : Topics 30.1 to 30.12 from Morrison and Boyd 6th ed.
 Topics 35.13, 35.14 and all problems like 35.20, 35.21, 35.24, 35.25(a), 8 (a to d, f), 11 and 12 from Morrison and Boyd 4th ed.
 Following topics from Heterocyclic chemistry Vol.II by R.R. Gupta, M. Kumar and V.Gupta.
 2.2.1.1.1 Knorr pyrrole synthesis
 2.2.1.2.2 Piloty-Robinson pyrrole synthesis
 2.2.1.3.1 Paal-Knorr synthesis
 2.5.3.5.1 Houben-Hoesch reaction
 2.5.3.5.3 Vilsmeier-Haack reaction
 3.2.5 Feist-Benary synthesis
 3.3 Structure of furan

- 3.4.1.1 Reactivity and orientation effect
- 3.4.1.2 Directing effect of substitution
- 3.4.1.3 Protonation
- 4.2.2.2 Paal synthesis of thiophene
- 4.3 Structure
- 4.4.1.1 Electrophilic substitution at carbon
- 4.4.1.1.1 Orientation
- 4.4.1.1.2 Directing effect on substituents
- 4.4.1.1.2.1 Substituents at carbon-2
- 4.4.1.1.2.2 Substituents at carbon-2
- 4.4.1.1.3 Protonation

Following topics from A Text book of organic chemistry by Arun Balh and B.S. Bahl.16^{ed}.

* Ureides and Purines (page no. 548 to 555).

* Indole and Indigo (page no. 784 to 787).

Multiple-choice questions (page no. 793 to 794).

N.B.: The multiple choice questions can also ask as fill up the blank

UNIT – VI [14 Marks]

DYES, PIGMENT AND DETERGENET

- 1.1 Introduction
- 1.2 Textile fiber or type of fiber (page 2 to 5, Gurdeep R. Chatwall)
- 1.3 Dyeing (page 5 to 8, Gurdeep R. Chatwall)
- 1.4 Fastness properties (page 13 to 14, Gurdeep R. Chatwall)
- 2.1 Bathochromic and hypsochromic effect (page 18 to 20, Gurdeep R. Chatwall)
- 2.2 Colour and constitutions (page 20 to 21, Gurdeep R. Chatwall)
- 2.3 Relation between colour and constitutions including (Witt's theory only).
- 2.4 Modern theories of colour and constitution (page 24 to 40, Gurdeep R. Chatwall)
- 4.1 Classification of Dyes (page 95 to 101) also from Hand book of synthetic Dyes and
 - * Pigments, Vol I synthetic Dyes, (page 3 to 8) By K. M. Shah.
 - * Pigments (Page 215 to 216 upto requirement, Gurdeep R. Chatwall)
 - Pigments (emulsion composition and dry powde) From Hand book of synthetic
 - Dyes and Pigments, Vol I, synthetic Dyes, By K. M. Shah (page 274 upto application).
 - Fluorescent Brightening agents (Page 228 to 229 (upto VII) , Gurdeep R.
 - Chatwall) also from Hand book of synthetic Dyes and Pigments, Vol. II, Chap. 3, synthetic Dyes, (page 97) By K. M. Shah.

* **Non-textile use of Dyestuff with atleast one examples. Detail consideration about food colorants and medicinal Dyes also from Hand book of synthetic Dyes and Pigments, By K. M. Shah.Vol. II, Chap. 1, synthetic Dyes, (page 3-4).
Synthesis and applications of following dyes from cheapest raw materials.**

- (i) **Direct Yellow 12 (page no. 20 and 39 from Hand book of synthetic Dyes and Pigments, Vol. I, Synthetic Dyes By K. M. Shah).**
- (ii) **Auramine O (page no. 119 Synthetic Dyes from from Hand book of synthetic Dyes and Pigments, Voll, By K. M. Shah or. Gurdeep R. Chatwal, page 146).**
- (iii) **New Magenta (page 121 from Hand book of synthetic Dyes and Pigments, Vol. I, By K. M. Shah).**
- (iv) **Disperse Orange 13 (page 150 from Hand book of synthetic Dyes and Pigments, Vol. I, Synthetic Dyes, By K. M. Shah).**
- (v) **Disperse Blue 1 (page 152 from Hand book of synthetic Dyes and Pigments, Vol. I, Synthetic Dyes, By K. M. Shah).**
- (vi) **Mercurochrome (page no. 163, 165, 166, Synthetic Dyes from Gurdeep R. Chatwal).**
- (vii) **Saframine T (page no. 171, Synthetic Dyes from Gurdeep R. Chatwal).**
- (viii) **Astrazon Pink FG (page no. 179, Synthetic Dyes from Gurdeep R. Chatwal).**
- (ix) **Caledon Jade Green (page no. 198, Synthetic Dyes from Gurdeep R. Chatwal).**
- (x) **Tartrazine (Application also consider from page 35, Hand book of synthetic Dyes and Pigments, Vol. II, Synthetic Dyes, By K. M. Shah).**
- (xi) **Procion Brilliant M5B**
- (xii) **Hansa Yellow**
- (xiii) **Ciba Blue 2B**
- (xiv) **Crystal Violet**
- (xv) **C.I. Disperse Blue**

Synthetic Detergent

Introduction

Comparison of soap and detergents

Principle of cleansing action of detergents

Classification of detergents (page 490 to 493 from Gurdeep R. Chatwall)

Detergents Builders and additives (page 504 to 506 from Gurdeep R. Chatwall)

Synthesis and applications of following dyes from cheapest raw materials.

(i) Miranol C2 M (ii) Tinopol RBX (iii) Igepon-T (iv) Sodium lauryl benzene

Book : (i) Synthetic Organic Chemistry by Gurdeep R. Chatwal.(ii) Hand book of synthetic Dyes and Pigments, Vol.I and II, Synthetic Dyes, By K. M. Shah).

N.B. The weightage of theory portion and synthesis is 7 marks and 8 marks respectively.

SARDAR PATEL UNIVERSITY

SYLLABUS OF T. Y. B. Sc.

ORGANIC CHEMISTRY (C - 302)

(Effective from June, 2008)

Total Marks 80 : No. of questions 06

UNIT – I [14 Marks] TERPENOIDS AND HORMONES

Terpenoids :

- 1.1 General introduction including nomenclature
- 1.2 General properties of terpenoids
- 1.3 Isolation
- 1.4 Isoprene rule
- 1.5 Classification of terpenoids
- 1.6 General methods for the determination of structure of terpenoids. (page 11 to 22).
- 1.11 Structure elucidation of Citral.
- 1.2 Structure elucidation of α - terpineol
- 1.14 Structure elucidation of Geraniol
- 1.15 Structure elucidation of Nerol
- 1.16 Structure elucidation of Linalool

Hormones :

- 4.10 Introduction, including difference between Hormones and Vitamins
- 4.11 Sex hormones
- 4.12 Oestrone (page 415-418, 421)
- 4.15 Testosterone (page 449 to 452)

Ref. Book : Organic chemistry of natural products by Gurdeep Chatwal, Vol. II (page 01 to 25, 36 to 42, 45 to 50, 59 to 63) and (page 413-418, 421, 449 to 452). Questions from A text book of Organic chemistry by A. Bahal & B. S. Bahal, 16th Ed. page no 814.

UNIT – II [13 Marks] ALKALOIDS

- 3.1 Introduction of alkaloids.
- 3.2 Occurrence of alkaloids.
- 3.3 Function of alkaloids.
- 3.4 Nomenclature.
- 3.5 Classification alkaloids.

- 3.6 Isolation of alkaloids.
- 3.7 Properties of alkaloids.
- 3.8 General methods employed for determining the structure of alkaloids.
- 3.10 Adrenaline.
- 3.20 Nicotine.
- 3.23 Quinine : without synthesis (up to page no.371).
- 3.25 Papaverine.

Ref. Book : Organic chemistry of natural products by Gurdeep Chatwal, Vol. I. (page no.280 to 300, 307 to 311, 340 to 345, 362 to 371).

UNIT – III [13 Marks] AMINO ACIDS AND PROTEINS

- 36.1 Proteins.
- 36.2 Structure of amino acids.
- 36.3 Amino acids as dipolar ions (including problem 36.1, 36.2 and 36.3).
- 36.4 Isoelectric point of amino acids.
- 36.5 Configuration of natural amino acids.
- 36.6 Preparation of amino acids.
- 36.7 Reaction of amino acids.
- 36.8 Peptides. Geometry of the peptide linkage.
- 36.9 Determination of structure of peptide. Terminal residue analysis. Partial hydrolysis.
- 36.10 Synthesis of peptides.
- 36.11 Proteins. Classification and function. Denaturation.
- 36.12 Structure of proteins.
- 36.13 Peptide chain.
- 36.14 Side chain. Isoelectric point. Electrophoresis.
- 36.15 Conjugated proteins. Prosthetic group. Enzymes, Coenzymes.
- 36.16 Secondary structure of protein.
- 36.18 Mechanism of enzyme action. Chymotrypsin.
- 36.19 Nucleoproteins and nucleic acids.

Problems : 36.1, 36.2, 36.3, 36.7, 36.12, 36.13, 36.14 (a) and (b), 36.20, 36.28 (a to c), 36.29 (a) and (b), 36.30, 2 (a) and (b).

Ref. Book : Organic chemistry, 6th Ed., By Morrison and Boyds. Questions from A text book of Organic chemistry by A. Bahal & B. S. Bahal, 16th Ed. page no 533 to 536.

UNIT – IV [14 Marks] DRUG

Introduction, classification of drugs.

Introduction and classification of following selected class of drugs including at least one examples of each class with **their structure** and uses.

Hypnotics, sedative and anticonvulsants (tribromoethanol, chloral, sulphones, noval, methyprylon, ethinamate, phenobarbitone, nirvanol, bromural, persedon, thiobarbitone, phenobarbitone).

Histamine and antihistaminic agents (benadryl, dimenhydrinate, chlorcyclizine hydrochloride, chlorpheniramine maleate, mepyramine, avil, soventol,

chlorophenir-amine, bonine, antistine). Hematological agents (dicoumarol, warfarin, folic acid).

Antipyretic and analgesics (antipyrene, aminopyrine, novalgin, phenacetin, cinchophen, aspirin, heptazone, novalgin, phenylbutazone), mode of action of antipyretic drug.

Anthelmintics (CCl₄, caprokol, hetrazan, gentian violet, phenothiazine, miracil-D, santonin).

Antimalarial (Quinine, chloroquine, pamaquine, azacrine, chloroguanide, pyrimethamine, DADS, lapinone). Antiseptic (glutraldehyde, salol, mercurochrome, chlorine, iodol, vioform, hexachlorophene, acriflavin, methylene blue, scarlet red).

Sulphanilamides (sulphanilamide, sulphamethazine, sulphafurazole, marfanil), mechanism of action of sulpha drug.

Antitubercular and antileprosy drugs (p-aminosalicylic acid, rifampin, dapsone, acedapsone).

Synthesis and uses of following drugs :

(i) Nirvanol (ii) Thiobarbitone (iii) Phenobarbitone (iv) Dimenhydrinate (v) Chlorcyclizine hydrochloride (vi) Novalgin (vii) Phenylbutazone (viii) Hetrazan (ix) Miracil-D (x) Chloroquine (xi) Primaquine (xii) Vioform (xiii) Sulphamethazine, (xiv) Sulphafurazole (xv) Marfanil (xvi) PAS (xvii) Dapsone (xviii) Acedapsone (xix) Warfarin (xx) Chlorpheniramine Maleate.

Ref. Book : Synthetic Drugs, VIth Ed. By Gurdeep R. Chatwal. (page no.1 to 23, 99, 100, 107, 111, 115, 120, 122, 170-173, 218-220, 223, 226, 257, 258, 262, 279-281, 285, 288, 294-297, 299, 301, 305, 321-323, 331, 353-355, 370, 372-374, 378, 382). Medicinal Chemistry 3rd ed By Ashutosh Kar. (page no. 418, 429, 442).

UNIT – V [13 marks] POLYNUCLEAR AROMATIC COMPOUNDS

- 34.1 Fused ring aromatic compounds.
- 34.2 Nomenclature of naphthalene derivatives.
- 34.3 Structure of naphthalene.
- 34.4 Reactions of naphthalene.
- 34.5 Oxidation of naphthalene.
- 34.6 Reduction of naphthalene.
- 34.7 Dehydrogenation of hydroaromatic compounds. Aromatization.
- 34.8 Nitration and halogenation of naphthalene.
- 34.9 Orientation of electrophilic substitution in naphthalene.
- 34.10 Friedal–Craft acylation of naphthalene.
- 34.11 Sulphonation of naphthalene.
- 34.12 Naphthols.
- 34.13 Orientation of electrophilic substitution in naphthalene derivatives.
- 34.14 Synthesis of naphthalene derivatives by ring closure (Haworth method).
Structure of
naphthalene from Organic Chemistry Vol. I by I.L. Finar, P. 794 only.
- 34.15 Nomenclature of anthracene and phenanthrene derivatives.
- 34.16 Structure of anthracene and phenanthrene.

- 34.17 Reactions of anthracene and phenanthrene.
34.18 Preparation of anthracene derivative by ring closure. Anthraquinone.
34.19 Preparation of phenanthrene derivative by ring closure.
34.20 Carcinogenic hydrocarbon. Arene oxides.
Problem: 34.5, 34.10, 34.18, 34.23, 34.24, 34.25, 34.26, 34.27, 34.28, 34.29, 34.10, 34.31, 5, 15.
Ref. Book : Organic Chemistry 4th Ed. By Morrison and Boyds. Questions from A text book of Organic chemistry by A. Bahal & B. S. Bahal, 16th Ed. page no 764 to 765, 771 to 772.

UNIT : VI [13 Marks] ORGANIC PHOTOCHEMISTRY

- 13.1 Principles of photochemistry.
13.1.1 Photochemical energy.
13.1.2 Electronic excitation.
13.1.3 Excited states, modes of dissipation of energy (Jablonski diagram) also from P. 460
Organic Reaction Mechanism By R.K. Bansal.
13.1.4 Energy transfer and photosensitization also from P. 461 Org. React. Mech. By R. K. B
13.2 Photochemistry of carbonyl compounds
13.2.1 Photoreduction
13.2.2 Norrish Type I reactions
13.2.3 Norrish Type II reactions; photochemical reactions of cyclic ketones
13.2.4 Paterno-Buchi reaction
13.2.5 Photochemistry of α , β -unsaturated ketones.
13.3 Photochemistry of olefins.
13.3.1 Cis-trans isomerification.
13.3.2 Dimerization reactions.
13.3.3 Photorearrangement of cyclohexadienones
Photo-Fries rearrangement (P. 344, Organic Reaction Mechanism by R.K. Bansal), Barton reaction (P. 473 Organic Reaction Mechanism By R. K. Bansal).
Ref. Book : Org. React. Mech. S.M. Mukerji, Org. React. Mech. R.K. Bansal. Org. chem..by R.O.C. Norman.

SARDAR PATEL UNIVERSITY
T.Y.B.Sc. (Effective from June 2008)
C-303

INORGANIC CHEMISTRY

Total marks :80

No. of Questions: 6

UNIT I [A] SYMMETRY:

Introduction, Various types of symmetry elements, Point groups, Properties of point groups, To determine the point group of a molecule, Representations of groups, The character, Some important theorems concerning the irreducible representations and their characters, Character table for point groups C_{2v} and C_{3v}

[B] INTRODUCTION TO THE TRANSITION ELEMENTS: LIGAND FIELD THEORY:

Introduction, Ligand field theory, The crystal field approach, The molecular orbital approach, Magnetic properties of transition metal complexes, Electronic absorption spectroscopy, Some generalizations concerning ligand field splitting and spectra, Structural and thermodynamic effects of d-orbital splitting

UNIT II

ELEMENTARY WAVE MECHANICS:

Wave equation, Interpretation of Ψ and Heisenberg's uncertainty principle, Properties of Ψ , Operators, Second postulate of quantum mechanics, Setting up of operators for different observable, Third postulate of quantum mechanics, Fourth postulate of quantum mechanics, One dimensional box, Normalization and orthogonality, Characteristics of the wave functions, Three-dimensional box, Electron in a ring, THE HYDROGEN ATOM: Transformation of coordinates, Separation of variables, The Φ equation, The θ equation, The radial equation.

UNIT III

THERMODYNAMIC AND KINETIC ASPECTS OF METAL COMPLEXES:

[A] STABILITY OF COMPLEXES IN AQUEOUS SOLUTION:

Definition of stability, stepwise formation of complexes, Stepwise formation and overall formation constants, kinetic vs. thermodynamic stability, labile and inert octahedral complexes according to CFT, factors affecting on the stability of complexes, experimental determination of stability constant and composition of a complex (spectrophotometric method, Job's method of continuous variation, potentiometric Bjerrum method)

[B] LIGAND SUBSTITUTION REACTIONS IN OCTAHEDRAL COMPLEXES:

Transition state or activated complex, types of substitution reactions, labile and inert complexes, acid hydrolysis reactions, base hydrolysis reactions of six-coordinated Co (III) ammine complexes, anation reactions, substitution reactions without breaking metal ligand bond.

[C] LIGAND SUBSTITUTION REACTION IN SQUARE-PLANAR COMPLEXES:

The trans effect, theories of trans effect, mechanism of substitution reactions, factors affecting the rates of substitution reaction in square planar complexes.

UNIT IV PRINCIPLES OF METALLURGY AND CHEMISTRY OF Fe, Ni,

Cu, Pb, Ag AND U.

Minerals and ores, General principles of metallurgy, ore dressing or concentration of ore, calcination and roasting, extraction of free metal. Refining or purification of metals, furnaces.

METALLURGY OF Fe, Ni, Cu, Ag, Pb AND U: -

Ni – Ores, extraction, crushing and concentration of the ore, production of Ni by Orford's process and Mond's process.

Cu – Ores, extraction, dressing of the ore. Roasting, treatment of matte for copper by Bessemerisation, refining or purification by electrolytic refining.

Fe – Occurrence, cast iron, wrought iron, steel – Bessemer process and open-hearth process.

U – Occurrence, extraction: Cupellation process, Amalgamation process, alkali digestion process. From carnotite ore, properties, compounds of uranium – uranium hexafluoride – UF_6 .

Ag – occurrence, extraction, Cupellation process, carbon reduction process, purification.

Pb: Occurrence, extraction, properties, uses, alloys and compounds of lead.

UNIT V **ORGANO METALLIC CHEMISTRY:**

Introduction, general methods of preparations, general properties, organo metallic compounds of alkali metals, organo metallic compounds of beryllium, magnesium, aluminum, metal olefin complexes, cyclopentadienyl complexes: metallocenes, some properties of ferrocene, structure and bonding in ferrocene molecule, ionic cyclopentadienyl compounds

UNIT VI

[A] BIOINORGANIC CHEMISTRY

Introduction, The role of model systems, The alkali and alkaline earth metals, Metalloporphyrins, Iron-sulfur proteins, Hemerythrin, Oxygen supply and transport, The bioinorganic chemistry of cobalt: Vitamin B₁₂, Metalloenzymes, Nitrogen fixation.

[B] CATALYSIS

Introduction, Description of catalysts, Properties of catalysts, Catalytic steps

Examples, The nature of catalysts, Catalytic steps, Examples

REFERENCE BOOKS:

SR.NO.	TITLE OF THE BOOK – EDITION	AUTHOR
1.	INTRODUCTORY QUANTUM	A K CHANDRA

	CHEMISTRY- 4 TH	
2.	BASIC INORGANIC CHEMISTRY- 3 RD	F.ALBERT COTTON GEOFFERY WILKINSON PAUL L. GAUS
3.	THEORITICAL INORGANIC CHEMISTRY- 2 ND	M.C.DAY & J.SELBIN
4.	SELECTED TOPICS IN INORGANIC CHEMISTRY – 7 TH	WAHID U MALIK G.D.TULI R.D.MADAN
5.	SATYAPRAKASH'S MODERN INORGANIC CHEMISTRY	R.D.MADAN
6.	ADVANCED INORGANIC CHEMISTRY VOLUME II- 18 TH	SATYA PRAKASH G.D.TULI S.K.BASU R.D.MADAN
7.	BASIC INORGANIC CHEMISTRY- 3 RD	F.ALBERT COTTON GEOFFERY WILKINSON PAUL L. GAUS
8.	TEXTBOOK OF INORGANIC CHEMISTRY- 20 TH	P.L.SONI

SARDAR PATEL UNIVERSITY
T.Y.B.Sc. (Effective from June 2008)
C-304
INORGANIC CHEMISTRY

Total marks: 80

No. of Questions: 6

UNIT I	<p>NUCLEAR CHEMISTRY AND RADIOCHEMISTRY Discovery of nucleus, Rutherford model of atom, properties of nucleus, composition of nucleus, atomic mass unit, nuclear stability, belt of stability, important points, meson theory of nuclear forces, decay processes, electron capture, positron emission, alpha decay, beta decay, internal conversion, lighter radioactive nuclides, theories of nuclear composition, proton electron theory, proton neutron theory, meson theory of nuclear forces, neutron proton theory, the antiproton neutron theory, nuclear mass, nuclear charge, nuclear size, nuclear spin and magnetic moment, structure of the nucleus, nuclear models, liquid drop model, shell model and magic numbers, fermi gas model, nucleon pairing, odd even effect binding forces in nucleus.</p>
UNIT II	<p>INDUSTRIAL CHEMISTRY (A) HEAVY CHEMICALS Manufacture, properties and uses of H₂SO₄, HNO₃, NH₃, NaOH (B) GLASS & CERAMIC INDUSTRY</p>

	<p>GLASS: Introduction, physical properties of glass, chemical properties of glass, characteristics of glass, raw materials, chemical reactions, methods of manufacture, formation of batch material, melting, chemical reactions in the furnace, shaping or forming, Forcault process of shaping sheet or window glass, shaping of plate glass, annealing, finishing, classification of glass making furnaces, methods of division of the tank and flame space, devices for recovery of heat of waste gases, electric and flame electric furnaces, flame electric furnaces, auxiliary furnaces, some special glasses.</p> <p>CERAMICS: what are ceramics, subdivision of ceramics, general properties of ceramics, permeable and impermeable wares, distinction between permeable and impermeable wares, classification based on reduction in porosity, basic raw materials, other ingredients, manufacturing process, grinding of raw material, mixing or preparation of bodies, body preparation using clay in plastic form, body preparation using dry clay, body preparation using clay slip, filtering, kneding, jollying, slit casting, pressing, extrusion, turning, drying, types of driers, firing, glazing, frits, decoration, application of colors to the pottery, porcelain and china, raw materials, manufacture, earthenware and stone wares, important points.</p>
UNIT III	<p>(A) INORGANIC POLYMERS Introduction, classification of inorganic polymers, general properties of inorganic polymers, polymers containing boron, silicon, phosphorus and sulfur.</p> <p>(B) INDUSTRIAL GASES Carbon dioxide, hydrogen, oxygen and nitrogen, rare gases of the atmosphere, helium, acetylene, sulfur dioxide, carbon monoxide, nitrous oxide.</p>
UNIT IV	<p>(A) ALLOY AND INTER-METALLIC COMPOUNDS: Introduction, Types of alloys, Rules for formation of alloys, Ferrous and non-ferrous alloys.</p> <p>(B) PASSIVITY & CORROSION Introduction to passivity, Alternative definition of passivity, Theories of passivity, Is passivity universal phenomenon?, Applications of passivity, Electrochemical passivity, Mechanical passivity, Introduction to corrosion, Economic aspects of corrosion, Types of corrosion, Corrosion by gaseous environment, Immersed corrosion, Prevention from corrosion.</p>
UNIT V	<p>(A) ISOMERISM AMONG INORGANIC COMPLEXES: Structural isomerism, stereo or space isomerism, geometrical isomerism in 4- and 6 coordination compounds, To distinguish cis- and trans-isomers, Optical or mirror image isomerism,</p>

	<p>Conditions for a molecule to have optical isomers, Optical isomerism in 4- and 6- coordination compounds, resolution of racemic mixtures.</p> <p>(B) CHEMISTRY OF METALLIC CARBONYLS AND METALLIC NITROSYLS :</p> <p>Metallic Carbonyls: General methods of preparation, general properties, Structure and nature of M-CO bonding in carbonyls, Effective atomic number (EAN) rule as applied to metallic carbonyls, 18-electron rule as applied to metallic carbonyls, Some carbonyls</p> <p>Metallic Nitrosyls: some metallic nitrosyls, effective atomic number (EAN) rule as applied to metallic nitrosyls.</p>
UNIT VI	<p>(A) THE CARBON FAMILY</p> <p>Group trends, Hydrides, Halides, Zeolites, Oxygen compounds of Germanium, Tin and Lead, Complexes of elements of Carbon family, Halides, oxides and salts.</p> <p>(B) INTER HALOGEN COMPOUNDS</p> <p>Inter halogen compounds, Introduction, Preparations, properties, structure and geometry of Inter halogen compounds of type XY, XY₃, XY₅ and XY₇.</p>

REFERENCE BOOKS:

SR.NO.	TITLE OF THE BOOK - EDITION	AUTHOR
1.	NUCLEAR & RADIATION CHEMISTRY- 6 TH	B.K.SHARMA
2.	TEXTBOOK OF INORGANIC CHEMISTRY- 20 TH	P.L.SONI
3.	INDUSTRIAL CHEMISTRY- 9 TH	B.K.SHARMA
4.	ADVANCED INORGANIC CHEMISTRY VOLUME I- 18 TH	SATYA PRAKASH G.D.TULI S.K.BASU R.D.MADAN
5.	SHREVE'S CHEMICAL PROCESS INDUSTRIES- 5 TH	GEORGE T. AUSTIN
6.	ADVANCED INORGANIC CHEMISTRY VOL-1, 23 RD	GURDEEP RAJ
7.	SELECTED TOPICS IN INORGANIC CHEMISTRY – 7 TH	WAHID U MALIK G.D.TULI R.D.MADAN
8.	ADVANCED INORGANIC CHEMISTRY- 5 TH	F.ALBERT COTTON GEOFFERY WILKINSON

Sardar Patel University
T.Y.B.Sc.
(Physical Chemistry)
C-305 (with effect from June 2008)

Unit: I Spectroscopy

(A) Rotational Spectroscopy:

- Diatomic molecules : Energy levels of a rigid rotor
- Selection rules spectral intensity
- Distribution using population distribution (Maxwell-Boltzmann Distribution)
- Determination of bond length
- Qualitative description of non rigid rotor, isotopic effects

(B) Vibrational Spectroscopy:

- IR Spectrum: energy levels of simple harmonic oscillator model
- Selection rules, pure vibrational spectrum, intensity
- Determination of force constant, P-Q-R bands
- Electronic spectrum – Franck-Condon principle
- Predissociation spectra
- Models of vibration of atoms in polyatomic molecules
- Vibrational coupling applications

Reference Books:

1. Instrumental Methods of Chemical Analysis by Chatwal and Anand
2. Physical Chemistry by B.K. Sharma

Unit-II Photochemistry

- Introduction
- Types of chemical reactions
- Difference between dark and photochemical reaction
- Absorption of light
- Laws of photochemistry
- Quantum yield or quantum efficiency
- Deviation in the law of photochemical equivalence
- Reasons of high & low quantum yield
- Factors affecting quantum yield
- Luminescence

- Fluorescence & phosphorescence
- Chemiluminescence
- Photosensitisation

Reference Book: Advanced Physical Chemistry by Gurdeep Raj

Unit: III X-ray Diffraction

- Crystal shapes and point groups
- Lattice and unit cells
- Miller Indices
- X-ray diffraction
 - Definitions
 - Bragg equation
 - Methods
- X-ray diffraction and unit cells
- Dimensions and the contents of the unit cell
- Ionic radii, covalent radii, van der Waals radii, radius ratio rules
- Lattice energies in ionic crystals
- Neutron diffraction

Reference Books:

1. Physical Chemistry by G.M. Barrow

2. Solid State Chemistry & its Applications by Anthony R. West

Unit-IV Colloidal State:

- Types of colloidal system.
- Classifications of colloids
- Lyophobic and lyophilic sol
- Size range, preparation and properties of colloidal solution
- Dialysis, electro dialysis
- Ultrafiltration, ultramicroscope
- Electrical properties
- Charge on colloidal particles
- Zeta potential
- Coagulation of colloidal solution
- Flocculation values
- Electrokinetic properties
- Electrophoresis, electrosmosis
- Determination of size and colloidal particles

- Importance and applications of colloids

Reference Book: Principles of Physical Chemistry by Puri, Sharma, Pathania

Unit-V Macromolecules-I

- *Introduction*
- Classification of Polymers
- Nomenclature of polymers
- Isomerism in polymers
- Intermolecular forces in polymers
- Chain growth polymerization – Introduction
- Mechanism of free radical, cationic and anionic polymerization
- Kinetics of free radical, cationic and anionic polymerization
- Mechanism and kinetics polycondensation

Unit: VI Macromolecules-II

- Polymerization techniques
- Concept of averages –
 - Number average mol. wt.
 - Weight average mol. wt.
 - Viscosity average mol. wt.
- Molecular weight and degree of polymerization
- Polydispersity and mol. wt. distribution.
- Methods for determination of molecular weight
- Membrane osmometry
- Vapour phase osmometry
- Viscometry
- Light scattering
- Numericals

Reference Books:

(i) Principles of Polymer Science by P. Bahadur & N.V.Sastry, Second Edition

(ii) Polymer Science by V.R.Gowariker, N.V.Vishwanathan & Jaydev Shreedhar

Sardar Patel University
T.Y.B.Sc.

(Physical Chemistry)
C-306 (with effect from June 2008)

Unit I: Nuclear Chemistry

- Natural Radioactivity & Laws of Radioactive Decay
- Half life, mean life
- General characteristics of radioactive decay
- Decay kinetics
- Types of radioactive decay
- Theory of α -, β -, γ -decay
- Electron capture
- Nuclear reactions
- Bethe 's notations
- Types of nuclear reaction
- Transmutations
- Radioactive capture reactions
- Photonuclear reactions
- Thermonuclear reactions

Reference Books:

- (i) Essential of Nuclear Chemistry by H. J. Arnikar
- (ii) Introduction to Nuclear Science by M. N. Sastri

Unit-II Chemical Kinetics and Catalysis

- Third order reactions
- Third order in gas and solution
- Complex reactions
- Determination of order of reaction
- Opposing reactions
- Consecutive reactions
- Period of induction
- Free radicals and chain reactions
- Simultaneous side reactions
- The activated complex theory
- Simple collision theory of reaction rates
- Failure of simple collision theory
- Reactions involving ions, primary salt effect
- Criteria of catalysis

- Homogeneous catalysis in gases and liquid phase
- Mechanism of acid base catalysis
- Salt effects, Enzyme catalyzed reactions
- Mechanisms of enzyme catalyzed reactions.

Reference Books:

- (i) Text Book of Physical Chemistry by Samuel Glasstone, Second Edition,
- (ii) Physical Chemistry by G.M. Barrow, Fifth Edition

Unit III Phase Equilibria

- The phase rule
- The phase diagram, the phase rule, theoretical derivation, the sulfur system, the water system,
- Distillation of liquid mixtures
- Partially miscible liquids and their distillation.
- Completely immiscible liquids
- Steam distillation
- Solid liquid system:
- Freezing point and solubility curves, solid phase consisting salt and water
- Continuous series of solid solution
- Reference Book: Text book of Physical Chemistry by Glasstone & D.Lewis, Second Edition

Unit: IV Surface Phenomenon and Adsorption

- Sorption
- Adsorption of gases
- Influence of temperature and pressure
- Nature of adsorbent and adsorbed gas
- Unimolecular layers
- Langmuir Adsorption Isotherm
- Types of adsorption
- Van der waals adsorption
- Chemisorption
- Persorption

- Adsorption at surfaces of solution
- Formation of unimolecular surface films of spreading oils (unimolecular insoluble film)
- Adsorption by solids from solution.

Reference Books:

1. Textbook of Physical Chemistry By Samuel Glasstone,
Second Edition

Unit: V Polarography

- Current - voltage relationship
- Interpretation of polarographic waves
- Equation for the polarographic waves
- Half wave potential
- Reversible wave & Irreversible waves
- Explanation of polarographic waves
- The charging or residual current
- The migration current
- The diffusion current
- The kinetic and catalytic currents
- Departure from diffusion & limited currents
- The dropping mercury electrode
- Advantages & Limitation of DME
- Removal of oxygen
- Applications of polarographic analysis
- Advantages of polarography
- Quantitative analysis
- Numericals

Reference Books:

- (i) Instrumental Methods of Chemical Analysis by B.K. Sharma
- (ii) Vogel's Text Book of Quantitative Chemical Analysis.

Unit: VI Solvent extraction methods and amperometric titrations

(A) Solvent Extraction methods in Analysis

- The distribution law
- Thermodynamic derivation
- Application
- Process of Extraction
- Factors affecting extraction
- Techniques for solvent extraction
- Quantitative treatment of solvent extraction equilibria
- Classification of solvent extraction system
- Types of extraction system
- Advantages of solvent extraction system
- Application of liquid extraction
- Solvent extraction methods in metallurgy
- Solid liquid extraction

(B) Amperometric Titrations:

- Amperometric titration
- Titrations with two indicator electrodes
- Instrumentation
- Indicator and reference electrode
- Titration procedure
- Advantages & disadvantages of amperometric titrations
- Applications

Reference Book

Instrumental Methods of Chemical Analysis by Chatwal & Anand

Additional Books for C- 305 & C- 306

1. Fundamentals of Molecular Spectroscopy, Fourth edition by Banwell, Colin N & Mc Cash
2. Basic concepts of Analytical Chemistry by S.M. Khopkar
3. Physical Chemistry through Problems by S K Dogra & S Dogra

T. Y. B.Sc.

Chemistry Practical Course (Physical Chemistry)

C-307

(One Practical of 3 hours from each group)

Group: A

1. Chemical kinetics of a reaction between $K_2S_2O_8$ and KI in an aqueous system.
2. The study of decomposition rate of hydrogen peroxide in presence of catalyst and catalyst with promoter.
3. The study of rate of reaction between hydrogen peroxide and KI in an aqueous media.
4. To determine the rate constant for the reaction between $KBrO_3$ and KI in an aqueous media.
5. The distribution coefficient of benzoic acid distributed between water and kerosene.
6. To study the adsorption of acid on activated charcoal.
7. To determine molecular weight of polymer by using ubbelhold viscometer.

Group: B

(A) Applications of pH metry

1. To determine molarity of strong/weak acid by titrating against 0.1M NaOH solution
2. The dissociation constant of a weak monobasic acids like HAC, formic acid, benzoic acid by titrating against 0.1 M NaOH
3. To determine molarity of each acid present in a mixture of strong acid and weak acid.
4. To measure the pH values of atleast two buffer solutions and to determine their respective buffer capacities.

(B) Applications of Potentiometry

5. To determine molarity of strong/weak acid
6. The dissociation constant of a weak monobasic acids like HAC, formic acid, benzoic acid & titrating against 0.1 M NaOH
7. To determine molarity of each acid present in a mixture of strong acid and weak acid.
8. To determine concentration of silver nitrate solution by titrating against 0.1 M NaCl/KCl solution.

9. To determine solubility and solubility product of sparingly soluble salt AgCl.
- (C) Application of conductometry
10. To determine cell constant of a given conductivity cell and solubility and solubility product of sparingly soluble salt (CaSO_4 , PbSO_4)
 11. To determine molarity of strong / weak acid by titrating against 0.1M NaOH solution
 12. To determine molarity of strong each acids present in a mixture of strong acid and weak acid.
 13. To determine concentration of silver nitrate solution by titrating against 0.1 M NaCl/KCl solution
- (D) Application of Refractometry
14. To determine the molar and specific refractions of pure liquids through the measurement of refractive index.
 15. To determine the composition of a binary liquid mixture by refractometry
- (E) Application of Colorimetry:
16. To determine the concentration of $\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$ by colorimetry

Reference Books:

1. Experimental Physical Chemistry by R. C. Das & B Behera.
2. Advanced Practical Physical Chemistry by J. B. Yadav.

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C – 308

ORGANIC CHEMISTRY (PRACTICAL)

Total Marks 80

- 1) **Separation and identification of three component organic mixture.**
- 2) **Preparations :**
 - a) **Preparation of iodoform from acetone**
 - b) **Preparation of p – nitroacetanilide**
 - c) **Preparation of p – bromoacetanilide**
 - d) **Preparation of 2, 4, 6 – tribromoaniline**
 - e) **Preparation of Methyl Orange**

- f) Preparation of Mordant yellow
- g) Preparation of Lake red
- h) Preparation of Benzoic acid
- i) Preparation of m-nitroaniline from m-dinitrobenzene
- 3) Estimation
- a) Estimation of - COOH group
- b) Estimation of Aspirin
- c) Estimation of Amine
- d) Estimation of amide
- e) Estimation of ketone
- f) To determine amount of acetic acid and ethyl acetate
- g) To determine the amount of unsaturation
- 4) Steam distillation
- Naphthalene from its suspension in water
 - Separation of o - and p - nitrophenols
- 5) Viva of 05 marks

C – 309 (Practicals)
INORGANIC CHEMISTRY

Total Marks 80

1.	SEMIMICRO INORGANIC QUALITATIVE ANALYSIS. (Three positive and three negative radicals). [30 Marks]	
2.	GRAVIMETRIC ANALYSIS 1. Al as Al_2O_3 2. Fe as Fe_2O_3 3. Ba as $BaSO_4$ 4. Ni as $Ni(DMG)_2$ 5. Cr as Cr_2O_3	[25 Marks]
3.	VOLUMETRIC ANALYSIS 1. Bi^{+3} by EDTA Method 2. Pb^{+2} by EDTA Method 3. Chloride by Mohr's method 4. Cd and Zn by EDTA method 5. Ca^{+2} from milk 6. Ca^{+2} from lime stone	[20 Marks]
4.	ALLOY ANALYSIS	

	1. Brass 2. Bronze
5.	SYNTHESIS AND ANALYSIS 1. tetramminecupricsulphate 2. cis and trans – bisoxalatodiaquochromate(III)
6.	COLORIMETRY 1. Job's method 2. Mole ration method
7.	SOLVENT EXTRACTION Separation and estimation of Mg(II) and Fe(II)
8.	ION EXCHANGE METHOD Separation and estimation of Mg(II) and Zn(II)
	VIVA VOCE [05 Marks]

NB: Electronic Balance should be provided for weighing along with the chemical balance.

REFERENCE BOOKS:

SR.NO.	TITLE OF THE BOOK – EDITION	AUTHOR
1.	VOGEL'S TESTBOOK OF QUANITATIVE CHEMICAL ANALYSIS 5 TH	G.H.JEFFERY, J.BASSET, J.MENDHAM, R.C.DENNEY
2.	VOGEL'S TESTBOOK OF QUALITATIVE INORGANIC ANALYSIS	G.SVEHLA
3.	PRACTICAL CHEMISTRY	O.P.PANDEY, D.N.BAJPAI AND S.GIRI
4.	AN ADVANCED COURSE IN PRACTICAL CHEMISTRY	GHOSHAL, MAHAPATRA, NAD