

SwamiRamanandTeerthMarathwadaUniversity, Nanded



स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड.

B.O.S. in Chemistry

B.Sc. Third Year (Chemistry)

Semester V & VI

New Revised Syllabus, In force from –June 2013

**B.Sc. III Year : Semester – V
(Chemistry)**

Paper No.	Course No.	Course	Periods/Week	Total Periods	Marks
XII	CH-301	Organic + Inorganic Chemistry	03	45	40+10 (Int.)
XIII	CH-302	Physical + Inorganic Chemistry	03	45	40+10 (Int.)

**B.Sc. III Year : Semester – VI
(Chemistry)**

Paper No.	Course No.	Course	Periods/Week	Total Periods	Marks
XIV	CH-303	Organic + Inorganic Chemistry	03	45	40+10 (Int.)
XV	CH-304	Physical + Inorganic Chemistry	03	45	40+10 (Int.)
XVI	CH-305	Laboratory Course – IV	04	120	50
XVII	CH-306	Laboratory Course –V	04	120	50

B.Sc. III Year : Semester – V
(Organic + Inorganic Chemistry)
Paper – XII (A+B) (CH-301)

Marks – 50

Periods - 45

Section – A
(Organic Chemistry)

Heterocyclic Compounds

Unit – I

06 P

- i) Introduction, Classification and nomenclature.
- ii) Molecular orbital structures, resonance structures and reactivity of furan, pyrrole thiophene and pyridine.
- iii) General mechanism of electrophilic substitution reactions of furan, pyrrole thiophene & pyridine.

[A] Five-membered heterocyclics

(1) FURAN : (OXOLE)

- 1.1.1 Synthesis from : a) Mucic acid b) Succinaldehyde
- 1.1.2 Physical Properties
- 1.1.3 Chemical Properties :
 - a) Electrophilic Substitution reactions :
 - i) Nitration ii) Sulphonation iii) Halogenation iv) Friedel-Crft's acylation
 - v) Gattermann-Koch reaction vi) Gombergreaction vii) Reaction with n-butyl lithium
 - b) Reduction
 - c) Diel's-Alder reaction

(2) PYRROLE : (Azole)

- 1.2.1 Synthesis from :
 - a) Acetylene b) Furan c) Succinimide
- 1.2.2 Physical properties
- 1.2.3 Chemical properties :
 - a) Electrophilic substitution reactions :
 - i) Nitration ii) Sulphonation iii) Halogenation iv) Friedel-craft acylation
 - v) Gattermann reaction vi) Reimer-Tiemann reaction vii) Coupling reaction
 - b) Reduction c) Ring expansion reaction d) Acidic character

(3) THIOPHENE (Thiole)

1.3.1 Synthesis from :

- a) Acetylene b) n-butane c) Sodium Succinate

1.3.2 Physical properties

1.3.3 Chemical properties

a) Electrophilic substitution reactions :

- i) Nitration ii) Sulphonation iii) Halogenation iv) Friedel-Craft acylation
v) Chloromethylation vi) Mercuration vii) Reaction with n-butyllithium

b) Reduction

Unit – II :

[B] Six-membered heterocyclics :

04 P

(1) PYRIDINE : (Azine)

2.1.1 Synthesis from

- a) Acetylene b) β -picoline c) Pentamethylenediamine hydrochloride

2.1.2 Physical properties

2.1.3 Chemical properties :

a) Electrophilic Substitution reactions :

- i) Nitration ii) Sulphonation iii) Bromination

b) Nucleophilic Substitution reactions : (General mechanism)

- i) Amination ii) Reaction with KOH iii) Reaction with n-butyllithium

c) Reduction d) Oxidation e) Basic Character

[C] Condensedheterocyclics :

(2) Indole : (Benzopyrrole)

2.2.1. Synthesis by :

- a) Fischer's Indole Synthesis b) Bischler's Indole Synthesis

(3) Quinoline : (Benzopyridine)

2.3.1 Synthesis by

- a) Skraup Synthesis b) Friedlander Synthesis

Unit – III :
Synthetic drugs and dyes

10P

(1) Synthetic drugs :

- 3.1.1 Introduction : qualities of good drug.
- 3.1.2 Classification of drugs based on therapeutic action :-
 - a) Functional drugs : (Antipyretics, Analgesics, Anaesthetics, Antidiabetics, Anti-inflammatory, Sedatives, hypnotics, tranquillizers)
 - b) Chemotherapeutic agents : (Antimalarials, Antibacterials, Antifungals, Antituberculars, Antibiotics, Antiseptics, Disinfectants, Antivirals)
- 3.1.3 Synthesis and uses of the following drugs :
 - a) Paludrine b) Paracetamol
 - c) Sulphanilamide d) Aspirin
 - e) Benzocaine f) Isoniazide
 - g) Sulphadiazine h) Tolbutamide

(2) Synthetic dyes :

- 3.2.1 Introduction, qualities of good dye
- 3.2.2 Classification of dyes based on methods of applications
- 3.2.3 Colour and chemical constitution :
 - a) Witt's theory b) Armstrong's theory
- 3.2.4 Synthesis and uses of the following dyes :
 - a) Phenolphthalein b) Methylorange
 - c) Alizarin d) Congo-Red
 - e) Diamond black-F f) Orange – II
 - g) Indigo h) Malachite green

Unit – IV :
Alkaloids, Vitamins and Pesticides

10P

(1) Alkaloids :

- 4.1.1 Introduction, occurrence and extraction.
- 4.1.2 Classification and general properties.
- 4.1.3 Determination of chemical constitution of alkaloids.

4.1.4 Constitution of the following alkaloids.

a) Ephedrine : (Synthesis from : 1-Phenyl propane-1, 2-dione)

b) Nicotine : (Synthesis from : Nicotinonitrile)

(2) Vitamins :

4.2.1 Introduction and classification.

4.2.2 Source, structure and deficiency diseases of the following vitamins :

a) Vitamin – A, D, E and K

b) Vitamin – B₁, B₂, B₃, B₆, B₁₂, and C

(3) Pesticides :

4.3.1 Introduction and classification :

(Insecticides, Herbicides, Fungicides and Rodenticides)

4.3.2 Synthesis and uses of the following pesticides :

a) DDT b) BHC c) 2, 4 – D d) Methoxychlor e) Carbaryl d) Monochrotophos

Section – B (Inorganic Chemistry)

Unit –V :

Hard And Soft Acids And Bases

05P

5.1.1) Classification of acids and bases as hard and soft ,

5.1.2) Pearsons HSAB concept,

5.1.3) Acid Base strength and Hardness and softness

5.1.4) Symbiosis

5.1.5) Theoretical basis of hardness and softness

5.1.6) Electro negativity and Hardness and softness

Coordination chemistry (Part-I)

10 P

5.2.1) Introduction: addition or molecular compound, double salt, coordination compound.

Comparison of double salt and coordination compound.

5.2.2) Terminology: complex ion, central metal atom, ligand, types of ligand, coordination number and coordination sphere.

5.2.3) Nomenclature: Rules of nomenclature of coordination compound, and its applications to nomenclature of simple and bridging complex compounds.

5.2.4) Werner's theory of coordination compound, postulates, applications with reference to $\text{CoCl}_3 \cdot 6\text{NH}_3$, $\text{CoCl}_3 \cdot 5\text{NH}_3$, $\text{CoCl}_3 \cdot 4\text{NH}_3$, $\text{CoCl}_3 \cdot 3\text{NH}_3$.

- 5.2.5)** Chelating agents and its classification, difference between metal complex and metal chelate complex.
- 5.2.6)** Isomerism: Structural isomerism, ionization, hydrate, linkage, coordination isomerism, geometrical isomerism, optical isomerism in 4 and 6 coordination complex.
- 5.2.7)** E. A. N. of metal complexes.

Reference Books :

- 1) Organic chemistry by S.M.Mukherji, S.P.Singh, R.P.Kapoor (Vol. II & III)
- 2) Organic Chemistry by Jagdamba Singh, L.D.S.Yadav (Vol. II & III)
- 3) A text book of organic chemistry by P.L.Soni, H.M.Chawla
- 4) A text book of organic chemistry by K.S.Tewari, S.N.Mehrotra, N.K.Vishnoi
- 5) A text book of organic chemistry by ArunBahl and B.S.Bahl
- 6) Principles of organic chemistry by M.K.Jain
- 7) Heterocyclic chemistry synthesis, reactions and mechanism by Raj K. Bansal
- 8) Reaction mechanism and reagents in organic chemistry by G.R.Chatwal
- 9) Synthetic organic chemistry by G.R.Chatwal
- 10) Natural products by O.P.Agarwal (Vol. I & II)
- 11) Spectroscopy of organic compounds by P.S.Kalsi
- 12) Elementary organic absorption spectroscopy by Y.R.Sharma
- 13) Absorption spectroscopy of organic molecules by V.M.Parikh
- 14) Chemistry of pesticides by K.H.Buchel (T.W.)
- 15) Polymer Science by V.R.Gowarikar, N.V.Viswanathan and JayadevSreedhar
- 16) Medical Chemistry by Burger
- 17) Organic Chemistry by Clayden, Greeves, Warren and Wothers
- 18) Reactions, Rearrangements and reagents by S.N.Sanyal
- 19) Synthetic organic chemistry by KamleshBansal
- 20) A text book of synthetic drugs by O.D.Tyagi, M.Yadav
- 21) Synthetic drugs by G.R.Chatwal
- 22) Synthetic dyes by G.R.Chatwal
- 23) Industrial Chemistry by B.K.Sharma
- 24) Organic Chemistry by Morrison and Boyd
- 25) Organic Chemistry by Carey
- 26) Organic Chemistry by L.G.Wade

- 27) Organic Chemistry by Cram D.J. and Hammond G.S.
- 28) Organic Chemistry by I.L.Finar
- 29) Advanced Organic Chemistry by Jerry March
- 30) Organic Chemistry by Fieser and Fieser
- 31) Principles of Inorganic Chemistry by Puri, Sharma and Kalia.
- 32) Inorganic Chemistry by Gurudeep Raj, Chatwal.
- 33) Advanced Inorganic Chemistry Vol. II by Satyaprakash, Tuli, Basu and Madan.
- 34) Inorganic Chemistry by huheey, Keiter and Keiter.
- 35) Concise Inorganic Chemistry by J.D. Lee.

Section-A
Physical chemistry

Spectroscopy:

Unit –I

09P

1.1 Introduction, Electromagnetic radiation and characteristics, Region of the spectrum. Width and intensity of spectral lines. Factors affecting width and intensity of spectral lines. Brief introduction to molecular spectra.

1.2 Rotational Spectra:

Classification of molecules, Rotational spectra of diatomic molecules: Rigid rotator model; moment of inertia; energy levels of rigid rotator, selection rules; spacing between spectral lines of diatomic rigid rotator, isotope effect, qualitative description of non rigid rotator. Numericals on bond length.

1.3 Vibrational Spectra:

Infrared spectrum, Simple Harmonic oscillator model, 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. Numericals on force constant.

Unit –II

2.1 Raman Spectra:

05P

Concept of polarizability. Classical and quantum theory of Raman scattering. Rotational Raman spectrum of a diatomic molecule, Rotation-vibration Raman spectrum, selection rules. Experimental Raman spectroscopy.

2.2 Electromagnetic spectra:

Concept of potential energy curve, Frank-Condon principle, types of electronic transitions.

Unit-III

Chemical kinetics

08P

3.1 Introduction, Third order reaction with equal concentration of all reactants, their characteristics.

3.2 Kinetics of complex reactions: i) Opposing reaction ii) Consecutive reaction iii) Chain reaction.

3.3 Kinetics of photochemical reactions: 1. Hydrogen-chlorine reaction.
2. Decomposition of HI. 3. Dimerization of Anthracene

Unit IV:

08P

Distribution Law

4.1 Introduction, Nernst distribution law, solubility and distribution law, Limitation of distribution law.

4.2 Association and dissociation of solute in solvent.

4.3 Henry's law.

4.4 Determination of equilibrium constant from distribution coefficient.

- 4.5 Extraction with solvent.
- 4.6 Liquid-liquid chromatography.
- 4.7 Applications of distribution law.
- 4.8 Numerical on Nernst distribution law.

Section-B
Inorganic chemistry

Unit V:

Organometallic compounds

09P

- 5.1.1) Definition
- 5.1.2) Nomenclature and classification of organometallic compounds
- 5.1.3) preparation, properties, bonding and application of alkyl and aryls of Li, Al, Sn, Ti.

Metal carbonyls

06P

- 5.2.1)** Definition, types 1) Mononuclear carbonyl, characteristics and examples; 2) Polynuclear Carbonyl, characteristics and examples.
- 5.2.2)** Preparation properties and structure of Nickel tetra carbonyl.
- 5.2.3)** Nature of metal carbon bond in metal carbonyl and their evidences.
- 5.2.4)** Structure of $\text{Fe}_2(\text{CO})_9$, $\text{Fe}_3(\text{CO})_{12}$, $\text{Ir}_4(\text{CO})_{12}$, $\text{Co}_2(\text{CO})_8$.

Reference Books:

1. Physical Chemistry by G. M. Barrow (Tata Mc-Graw Hill publishing Co., Ltd.)
2. Elements of Physical Chemistry by S. Glasstone & D. Lewis (D.vannostrand co. inc.)
3. Physical Chemistry by W. J. Moore (Orient Longman).
4. Principles of Physical Chemistry by S. H. Maron and C. F. Prutton.
5. University General Chemistry by C. N. R. Rao (Mc-Millan).
6. Elements of Physical Chemistry by P. W. Atkins. (Oxford University Press).
7. Physical Chemistry by R. A. Alberty (Wiley Eastern Ltd.).
8. Physical Chemistry through problems by S. K. Dogra, D. Dogra (Wiley Eastern Ltd)
9. Principles of Physical Chemistry by Puri, Sharma and Pathania (Vishal Publication Jalandher, Delhi)
10. Physical Chemistry by A. J. Mee. ELBS & Heinemann Educational Books Ltd.
11. Essentials of Physical Chemistry by ArunBhal, B. S. Bahl and G. D. Tuli. (S. Chand)
12. Chemical Kinetics by K. J. Laidler (Tata Mc-Graw Hill Publishing Co. Ltd).
13. Text Book of Physical Chemistry by Soni-Dharmarha.
14. A Text Book Physical Chemistry by S. Glasstone, (Mac Millan.)
15. Advanced Physical Chemistry by D.N.Bajpai. (S.Chand)
16. Advanced Physical Chemistry by Gurdeep Raj. (Goel publishing house, Meerut).
17. Principles of Inorganic Chemistry by Puri, Sharma and Kalia.
18. Inorganic Chemistry by Gurudeep Raj, Chatwal.
19. Advanced Inorganic Chemistry Vol. II by Satyaprakash, Tuli, Basu and Madan.
20. Inorganic Chemistry by huheey, Keiter and Keiter.
21. Inorganic Chemistry by J.D. Lee.