DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

SYLLABUS

B.Sc. (Chemistry)

FIRST YEAR

[Effective from - June, 2013-14 onwards]

B.Sc. Chemistry

(Three year Degree Course)

First Semester

Paper I Inorganic Chemistry 3 Credits (45 Hrs)
3 Hrs. / Week

I Atomic Structure: 15 Hrs.

Atomic orbital's, Quantum numbers, Heisenberg uncertainty principle, shapes of s, p, d orbital's. Aufbau and Pauli exclusion principles. Hund's multiplicity rule. Electronic configurations of the elements, Bohr's atomic model (Qualitative aspect only).

II Periodic Properties: 10 Hrs.

Atomic and Ionic radii, Ionization Energy, Electron affinity and Electro negativity. Trends in periodic table and application in predicting and explaining the chemical behavior.

III S-Block Elements: 10 Hrs.

Comparative study, diagonal relationship, salient features of hydrides, solvation and complexation tendencies including their functions in biosystems.

IV P - Block Elements: 10 Hrs.

Comparative Study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides oxides of groups 13-16. Interhalogen compounds and its types.

First Semester

Paper II Organic Chemistry 3 Credits (45 Hrs)
3 Hrs. / Week

I. Structure and Bonding: 6 Hrs.

Localized and delocalized chemical bond; charge transfer complexes, resonance, hyper conjugation, inductive effect, hydrogen bonding, conjugative effect, steric effect.

II Mechanism of Organic Reactions: 8 Hrs.

Homolytic and heterolytic bond breaking. Types of reagents eletrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediates - carbocations, carbanions, free radicals (with two examples each) Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereo - chemical studies with two examples each)

III Stereochemistry of Organic Compounds : 8 Hrs.

Concept of Isomerism - Types of isomerism

Optical Isomerism - elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of

enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds.
Relative and absolute configuration, sequence rules, D and L and R and S systems of nomenclature.
Geometric Isomerism - Determination of configuration of geometric isomers. E and Z system of nomenclature, geometric isomerism in oximes and alicylic compounds.

IV Alkanes : 6 Hrs.

Methods of formation (Koble reaction, Corey - House reaction and decarboxylation of carboxylic acids)
Physical properties and Chemical reactions of alkanes

V Alkenes : 6 Hrs.

Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes - mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration and oxidation with $KMnO_4$. Polymerization of alkenes with one example each.

VI Arenes and Aromaticity: 6 Hrs.

Nomeclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain structure of benzene : molecular formula and Kekule structure. Resonance Structure, MO Picture.
Aromaticity : The Huckel rule, aromatic ions
Aromatic electrophilic substitution: General Pattern of the mechanism (Nitration, halogenations and Sulphonation) and Friedel Crafts reaction.

VII Alkyl and Aryl halides: 5 Hrs.

Polyhalogen Compounds: Chloroform, Carbon tetrachloride. Methods - formation of aryl halides, nuclear and side chain reaction.

First Semester

Paper III Lab Course I 45 Hrs. 3 Hrs / Week

I Volumetric Analysis : 15 Hrs.

- Calibration of Burette and Pipettee
- Preparation of 0.1N. NaOH solution and its standardization by given oxalic acid solution.
- Preparation of 0.1 N oxalic acid solution and its standardization by given $KMNO_4$ solution.

II Inorganic Qualitative Analysis : 30 Hrs.

- Identify two acid and two basic radical from the given binary mixture.

a] $CdSO_4 + NH_4Cl$ b] $BaCO_3 + Al_2(NO_3)_3$
c] $ZnCO_3 + KBr$ d] $MnCO_3 + MgSO_4$
e] $NiSO_4 + MgCO_3$

First Semester

Paper IV Lab Course II 1.5 Credits (45 Hrs.)
3 Hrs / Week

- Eudiometer : Determination of Equivalent weight of Mg
- Viscometer : To Determine Viscosity of given

liquid (Water / Ethanol) by
viscometer
 Staglanometer : To determine surface tension of
given liquid.
 Chemical Kinetics : * To study the effect of acid strength
on the hydrolysis of an ester.
* To determine the specific reaction
rate of the hydrolysis methyl / ethyl
acetate catalyzed by hydrogen ions at
room temperature.

Second Semester

Paper V Physical Chemistry 3 Credits (45 Hrs)
3 Hrs. / Week

I Mathematical Concepts : 10 Hrs.

Logarithmic relations, curve sketching, linear graphs and calculation of slopes, differentiation of functions like k^x e^x, x^n, sin x, log x; maxima and minima, partial differentiation.

II Gaseous States: 6 Hrs.

Postulates of kinetic theory of gases, kinetic gas equation, Deduction of Gas Laws : Boyles Law, Charles Law, Grahams Law of diffusion, Avogadro's hypothesis, deviation from ideal behavior, van der Waals equation of state. Critical Phenomena : PV isotherms of real gases.

III Chemicals Kinetics and Catalysis: 12 Hrs.

Chemical Kinetics and its scope, rate of reaction, factors influencing the rate of reaction - concentration, temperature, pressure, solvent, light, catalyst concentration dependence of rates. Derivation of rate law and characteristics of simple chemical reactions - zero order, first order, second order, Pseudo order, half life. Effect of temperature on rate of reaction. Arrhenius equation, concept of activation energy.
Catalysis : Definition, types, and characteristics of catalysis, homogeneous, heterogeneous catalysis - Enzyme catalysis and its application.

IV Liquid State: 6 Hrs.

Intermolecular forces, structure of liquids (a qualitative description). Differnce between solids, liquids and gases.
Liquid Crystals: Classification, structure of nematic and cholestric phases.

V Solid State : 6 Hrs

Types of solids, Amorphous, crystalline and difference between them, Miller Indices.
Laws of crystallography - (i) Law of constancy of interfacial angels (ii)Law of rationality of indices (iii) Law of symmetry. Symmetry elements in crystals. X-ray diffraction by crystals. Derivation of Bragg equation.

VI Colloidal State : 5 Hrs

 Definition of colloids, classification of colloids.
 Solids in liquids (sols) : properties - kinetic, optical and electrical; stability of colloids, protective action. Hardy - Schulze Law.
 Liquids in liquids (emulsions) : types of emulsions, preparation.
 Liquids in Solids (gels) : classification, preparation and properties, general applications of colloids.

Second Semester

Paper VI Inorganic Chemistry - II 3 Credits
3 Hrs. / Week

I Chemistry of noble gases : 5 Hrs.

Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

II Chemical Bonding: 20 Hrs.

(A) Covalent Bond - Valence theory and its limitations, directional characteristic of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions, Valence shell electron pair repulsion (VSEPR) theory of NH_3, SF_4, CIF_3, ICI_2 and H_2O. MO theory, homonuclear (He, N_2 and O_2) and heteronuclear (CO and NO) diatomic molecules, bond strength and bond energy, percentage ionic character from dipole moment and electro negativity difference.

(B) Ionic Bonds - Definitions, Factors affecting ionic bond formation.

(C) Hydrogen bonding, Van-der-Waals forces, Metallic bond and its free electron concept.

III Nuclear Chemistry: 10 Hrs.

Definition; Atomic number, mass number, Isotopes, Isobars mass defect and Binding Energy, Packing fraction N/Z ratio, Radio activity, properties of α, β and γ, Artificial transmutation. Applications with respect to trans-uranic elements, carbon dating.

IV Theory of volumetric Analysis: 10 Hrs.

Types of titrations, volumetric apparatus, calibration of pipette and burette. Indicators used in pH - titrations, oxidizing agents used in titrations. Theory of Internal, External and self indicators for redox titration.

Second Semester

- Standardization of NaOH solution by (0.1 N) oxalic acid solution and estimation of given HCl solution.
- Standardization of $KMnO_4$ solution by (0.1 N) oxalic acid solution and estimation of Ferrous ion (Fe^{2+}) from the given solution.
- Preparation of (0.1 N) Sodium Thiosulphate and standardization by given iodine solution.

I Organic Qualitative Analysis: 30 Hrs.

Nature / Functional group / Element / Derivative / Physical constant
* Benzoic acid, * salicylic acid, * β-naphthol, * p-nitroaniline,
* Naphthalene, * Acetanilide.

II Organic Estimation: 15 Hrs.

- Phenol by Bromination
- Estimation of basicity, molecular weight of organic acid (oxalic/acetic acid)

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REVISED SYLLABUS

OF

B.Sc. Chemistry

SECOND YEAR

[Optional]

Third & Fourth Semester

[Effective for - June, 2014-15]

B.Sc. Chemistry

(Three Year Degree Course)

Second Year (Third Semester)

Paper VII Organic Chemistry Third Semester

(45 hrs)

3Hrs / Week

1 Alcohols 06 Hrs
2 Phenols 06 Hrs
3 Aldehydes and Ketones 10 Hrs
4 Carboxylic Acids 09 Hrs
5 Organic Compounds' of Nitrogen 14 Hrs

Paper VIII Physical Chemistry (45 hrs)

3Hrs / Week

1 Thermodynamics-I 15 Hrs
2 Thermodynamics-II 20 Hrs
3 Chemical Equilibrium 10 Hrs

Paper IX Lab Course III (Physical / Inorganic) 90 Hrs

2.S-[F] SU-02 June-2014-2015 All Syllabus Science Faculty B. Sc. II Yr. Chemistry [Sem.III & IV]+ - 8 -

Second Year (Fourth Semester)

Paper X Inorganic Chemistry Fourth Semester

(45 hrs)

3Hrs / Week

1 Chemistry of Elements of First
Transition series
10 Hrs
2 Coordination compounds 10 Hrs
3 Chemistry of Lanthanides 06 Hrs
4 Chemistry of Actinides 05 Hrs
5 Acids and Bases 06 Hrs
6 Non Aqueous solutions 08 Hrs

Paper XI Physical Chemistry- II (45 hrs)

3Hrs / Week

1 Phase Equilibrium 15 Hrs
2 Electro-Chemistry-I 15 Hrs

3 Electro-Chemistry-II 15 Hrs

Paper XII Lab Course IV (Physical / Organic) 90 Hrs

B.Sc. (Second Year)
(Third Semester)

Organic Chemistry Paper VII 45 Hrs

1) Alcohols: 06 Hrs.

Definition: *Monohydric Alcohols:* Methods of Formation by reduction of Aldehydes, Ketones, Carboxylic Acids and Esters (one e.g. each) Acidic Nature, Reactions of Alcohols.

Dihydric Alcohols: Method of Formation of Ethylene Glycol-industrial method and From Alkenes using Oso_4, Chemical Reactions of Ethylene Glycolnitration, Acylation, Oxidation (Using Pb (OAc)4 without Mechanism Pinacol-Pinacolone rearrangement, *Trithydric Alcohols:* Preparation of Glycerol from propane, Reactions of Glycerol.

2) Phenols: 06 Hrs.

Preparation of Phenol from Cholorobenzene, Cumene and Benzene Sulphonic Acid, Physical properties, Acidic Nature of Phenol, Resonance stabilization of Phenoxide Ion. Reactions of Phenols-Electrophilic Aromatics Substitution, Acylation, Carboxylation (Without Mechanism) Reactions with Mechanism-intermolecular Fries Rearrangement, Claisen Rearrangement, Gattermann Synthesis and reamer Tiemann Reaction.

3) Aldehydes and Ketones: 10 Hrs.

Aldehydes: Preparation of Aldehydes from Acid Chloride, Gattermann-Koch Synthesis *Ketones*-Preparation from Nitriles and from Carboxylic Acid, Physical Properties of Aldehydes and Ketones. Mechanism of Nucleophilic Additions to Carbonyl Group with particular emphasis on Benzoin, Aldol Knoenenagel condensations, Mannich Reactions. Use of Acetals as Protecting Group. Oxidation of Aldehydes using Chromium Trioxide, Baeyer-Villeger Oxidation of Ketones.

4) Carboxylic Acids: 09 Hrs.

Acidity of Carboxylic Acids, Effects of substituent's of substituents on Acid strength, preparation of Acetic Acid from Co2 from Nitriles, from Acid Chloride, Anhydride, Ester and Amide. Physical Properties and reactions of Carboxylic Acids-Synthesis of Acid Chloride, Ester and Amide, Hell-Volhard-Zelinsky Reaction. Reduction using LiAIH4, Mechanism of Decarboxylation, hydroxyl Acids-Malic, Tartaric and Citric Acid. Methods of Formation and Chemical reactions of Acrylic Acid.

5) Organic Compounds of Nitrogen: **14 Hrs.**

Preparation of *Nitroalkanes.* Nitration of Benzene and Their Reduction in Acidic, Neutral and Basic Media.

Amines-Basicity of Amines, Amine Salt as PTC. Preparation of Alkyl and Aryl Amines (Reduction of Nitro Compounds', Nitriles) Reductive Amination, Hoffmann Bromamide Reactions. Reactions of Amines-Electrophilic Aromatic Substitution in *Aryl amines,* Reactions of Amines with Nitrous Acid.

B.Sc. (Second Year)
(Third Semester)
Physical Chemistry Paper VIII 45 Hrs (3 Hrs/week)
1) Thermodynamics: I 15 Hrs.
Definition: *of Thermodynamic Terms:* System, Surrounding types of system, intensive and extensive properties. Thermodynamic Process, Concept of heat and work. Work done in reversible and irreversible process, concept of maximum work (W_{max}), Numerical Problems.
First law of Thermodynamics: Statement, Definition of Internal energy and Enthalpy.
Heat capacity, heat capacities at constant volume pressure and their relationship. Calculation of W,q, du and dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process, Numerical problems, Hess's law of heat Summation and its application.
2) Thermodynamic-II: 20 Hrs.
Second Law of Thermodynamics: Need for the law, different statement of the law Carnot Cycle and its efficiency, Numerical Problems. Carnot Theorem. Concept of Entropy: Definition, Physical significance, Entropy as a State Function, Entropy change in Physical change, Entropy as criteria of Spontaneity & Equilibrium Entropy Change in Ideal Gases. Gibbs and Helmholtz Functions: Gibbs Function (G) and Helmoltz Function (A) as Thermodynamic Quantities. A and G as criteria for Thermodynamic Equilibrium and Spontaneity, their Advantage over Entropy change. Variation A with P, V and T.
3) Chemical Equilibrium: 10 Hrs.
Equilibrium Constant and Free Energy. Thermodynamic Derivation of Law of Mass Action. Le Chatelier's Principle. Reaction Isotherm and Reaction Isochore. Clapeyron Equation, Clausius-Clapeyron Equation and its Application.

B.Sc. (Second Year)
(Third Semester)
Lab Course-III
Paper IX 90 Hrs (6 Hrs/week)
Section A (Physical Chemistry)
Non Instrumental (Any Five)
i. To determine critical solution temperature of Phenol- water system.
ii. To determine solubility of benzoic acid at different Temperature and determine H of dissolution process.
iii. To determine heat of neutralization (Hn) of Na OH and HCl
iv. To determine heat of neutralization (Hn) of Na OH and Acetic acid.
v. Partition coefficient of Benzene-water system using benzoic acid.
vi. To determine the equilibrium constant for the reaction: $KI + I_2$ --- > KI_3.
vii. Determine the molecular mass of polymer from viscometry measurements.
viii. To investigate the Kinetics of iodination of Acetone.

Section B (Inorganic Chemistry)

Gravimetric Estimation: (Any Three)

i. Estimation of Zinc gravimetrically as Zinc ammonium phosphate ($ZnNH_4PO_4$)
ii. Estimation of Mn gravimetrically as Manganese Ammonium Phosphate ($MnNH_4PO_4$)
iii. Estimation of Nickel gravimetrically as Ni-DMG
iv. Estimation of Barium gravimetrically as Ba-Chromate ($BaCrO_4$)
v. Estimation of Aluminum as Aluminum Oxinate.
vi. To determine the equilibrium constant for the reaction: KI + I_2-KI_3
vii. Determine the molecular mass of polymer from viscometry measurements.
viii. To investigate the Kinetics of Iodination of acetone.

Complexometric Titration: (Any Two)

i. Estimation of Zinc by EDTA solution using EBT indicator.
ii. Estimation of Nickel by EDTA using Murexide indicator
iii. Estimation of copper by EDTA using fast sulphon black F
indication
iv. Estimation of Lead By EDTA using Xylenol Orange indicator.

B.Sc. (Second Year)
(Fourth Semester)

(Inorganic Chemistry) Paper X 45 Hrs (3 Hrs/week)

1) Chemistry of Elements of First Transition Series: 10 Hrs.

General Characteristic features of d-block elements. Properties of the elements of the first transition series: Ionic Size, Atomic Size, Metallic properties, Ionization potential, magnetic properties, Oxidation State.

2) Co-ordination Compounds: 10 Hrs

Werner's Co-ordination Theory and its experimental verification effective atomic Number concept, chelates, nomenclature of co-ordination compounds, isomerism in co-ordination compounds, valence bond theory of transition metal complexes.

3) Chemistry of Lanthanide Elements: 06 Hrs.

Occurrence and Isolation of Lanthanides,Electronic Configuration Oxidation states, Ionic Radii, Lanthanide Contraction and its Consequences.

4) Chemistry of Actinides: 05 Hrs.

Occurrence, Position in the periodic table, Electronic configuration. Oxidation State, chemistry of separation of Np, Pu and Am from U

5) Acids and Bases: 06 Hrs.

Arrhenius, Bronsted-Lawry, The Lux-Flood, Solvent System and Lewis Concept of Acids and Bases

6) Non- Aqueous Solvents: 08 Hrs.

Physical Properties of a solvent, Types of Solvents and their general Characteristics, Reaction in Non-Aqueous Solvents with reference to liquid NH_3 and liquid SO_2.

B.Sc. (Second Year)
(Fourth Semester)

Physical Chemistry-II Paper XI 45 Hrs (3 Hrs/week)

1**) Phase Equilibrium: 15 Hrs.**

Statement and Meaning of the Terms*: Phase, Component*, Degree of Freedom, Derivation of Phase Rule Equation. Phase Equilibria of the One Component System: Water System. Phase Equilibria of Two Components System: Solid-Liquid Equilibria, Simple Eutectic Pb-Ag. System Desilverisation of Lead. Solid Solutions: Compound Formation with congruent Melting Point (Mg-Zn) and Incongruent Melting Point ($FeCl_3$-H_2O) System. Freezing Mixture, Acetone-Dry Ice.

Liquid-Liquid Mixture: Raoult's Law and Henry's Law.

Ideal and Non-Ideal system. Azeotropes: HCl-H_2O and Ethanol-Water System.

Partially Miscible Liquids: Phenol-Water, Trimethyl Amine-Water, Nicotinewater System, Lower and Upper consulate Trimethyl Amine-Water, Nicotinewater system, Lower and Upper Consulate Temperature. Effect of Impurity on Consulate Temperature.

2) Electro Chemistry-I 15 Hrs.

Electrical Transport: Conduction in metals and in Electrolyte Solutions. Specific Conductance and equivalent conductance, measurement of equivalent conduction, variation of equivalent and specific conductance with dilution. Numerical problems. Kohlrausch's law and its application.

Arrhenius Theory of Electrolyte Dissociation and its limitations. Weak and Strong Electrolytes, Ostwald's Dilution Law, its use and Limitations.

Transport Number: Definition, Determination by Hittorfs Method and Moving Boundary Method. Conductometric Titration: Types and its advantages.

3) Electrochemistry-II 15 Hrs

Types of Reversible Electrodes: Gas- Metal Ion, Metal-Metal Ion, Metal-Insoluble salt Anion and Redox Electrodes. Nernst Equation, Derivation of Cell, E.M.F. and single Electrode potential, Standard Hydrogen Electrode, Reference Electrodes, Standard Electrode Potential, Sign Conventions, Electro-Chemical Series and its significance. Electrolytic and Galvanic Cells, Reversible and Irreversible Cells, Conventional Representation of Electro Chemical Cells. E.M.F. of a cell and its measurement, Calculation of Thermodynamic Quantities of Cell Reactions (G, H and K)

Definition of pH, pKa-Determination of pH using SHE and Glass Electrode by Potentiometer method. Buffer-Acidic and Basic Buffers, Mechanism of Buffer Action, Henderson-Hasselbalch equation.

Corrosion: Dry (Atmospheric) Corrosion and Wet (Electro-Chemical) Corrosion Electrochemical Theory of Corrosion.

B.Sc. (Second Year)
(Fourth Semester)
Lab Course-IV Paper XII 90 Hrs (3 Hrs/week)
Section A: Physical Chemistry
Instrumentation: (Any Five)

i. To determine normality and strength of HCI using (0.1N) NaOH Solution Conductometrically.

ii. To determine normality and strength of acetic acid using (0.1N) NaOH solution Conductometrically.

iii. To determine normality and strength of HCI using (0.1N) NaOH solution by pH-metrically.
iv. To verify Lambert-Beers Law using $KMn0_4$ solution.
v. To estimate the amount of Sugar using Polarimeter.
vi. To determine refractive index of ethanol water system.
vii. To determine indicator constant of indicator colorimetrically.

Section B: Organic Chemistry

Organic Derivatives:- Preparation, Crystallization and Physical Constant. (Any Three)

i. Acetyl Derivatives : a) Aniline b) Salicylic Acid
ii. Benzoyl Derivatives : a) Aniline b) B-naphtol
iii. Hydrolysis Derivatives : a) Ethyl Benzoate b) Aspirin
iv. Bromo-Derivatives : a) Phenol b) Cinnamic Acid
v. Reduction Derivatives : a) M-dinitrobenzene
vi. Osazone Derivatives : a) Sucrose b) Glucose

Organic Estimations: (Any Two)

i. Estimation of nitro group by reduction.
ii. Estimation of glucose.
iii. Estimation of ester by hydrolysis.
iv. Estimation of amides by hydrolysis.

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SYLLABUS

B.Sc. (Chemistry)

THIRD YEAR

SEMESTER SYSTEM

FIFTH / SIXTH SEMETER
[Effective from – June- 20**15 onwards]**
DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGBAD
B.Sc. (Chemistry) IN SEMESTER PATTERN FOR THREE YEAR DEGREE

B.Sc. CHEMISTRY
(Three Year Degree Course)

THIRD YEAR
Paper XIII Physical Chemistry Fifth Semester
(45hrs)
3 **Hrs/ Week**
I. Elementary Quantum Mechanics 10 Hrs.
II. Spectroscopy 10 Hrs.
III. Photochemistry 08 Hrs.
IV. Physical Properties and Molecular Structure 10 Hrs.
V. Nano Material 07 Hrs.
Paper XIV Organic Chemistry Fifth Semester
(45hrs)
3 **Hrs/ Week**
I. Spectroscopy 16 Hrs.
II. Organometallic Compounds 08 Hrs.
III. Organic Synthesis via Enolates 13 Hrs.
IV. Fats, Oils and Detergents 08 Hrs.
Paper – XV Lab. Course V Organic Chemistry and
(45 Hrs)
Inorganic Chemistry
(45 Hrs)
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B.SC. CHEMISTRY
(Three Year Degree Course)
THIRD YEAR
Paper XVI Inorganic Chemistry Sixth Semester
(45hrs)
3 **Hrs/ Week**
I. Metal-ligand Bonding in Transition Metal Complexes 12 Hrs.
II. Electron Spectra of Transition Metal Complexes 07 Hrs.
III. Organometallic Chemistry 10 Hrs.
IV. Bioinorganic Chemistry 10 Hrs.
V. Chromatography 06 Hrs.
Paper XVII Organic Chemistry Sixth Semester
(45hrs)
3 **Hrs/ Week**
I. Heterocyclic Compounds 13 Hrs.

II. Carbohydrates 10 Hrs.
III. Synthetic Polymers 07 Hrs.
IV. Synthetic Dyes and Drugs 15Hrs.

Paper – XVIII Lab. Course VI Organic Chemistry &
(45 Hrs)
Physical Chemistry
(45 Hrs)

B. SC. THIRD YEAR
Paper XIII Physical Chemistry [Vth Semester]
45 Hrs. (3 Hrs/week)

I Elementary Quantum Mechanics 10 Hrs.

Black body radiation, Planck's radiation law, photoelectric effect, Bohr's modes of hydrogen atom (no derivation) and its defects. Compton effect. De Broglie Hypothesis, the Heisenberg's uncertainty principles, Harmiltonian operator, Schrödinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics. Schrödinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance.

II Spectroscopy 10 Hrs.

Introduction - Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation. Rotational Spectrum - Diatomic molecules, energy levels of a rigid rotor (semi classical principles), selection rule, rotational spectra of rigid diatomic molecule, determination of bond length, numerical problems.

III Photochemistry 08 Hrs.

Introduction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry, Grothus - Drapper law, Stark-Einstein law, Jablonsiki diagram qualitative description of fluorescence, phosphorescence, non-radiative processes (Internal conversion, Intersystem crossing), quantum yield, photosensitized reactions.

IV Physical properties and molecular structure 10 Hrs.

Optical activity and its measurement, dipole moment and its measurement by temperature change method, magnetic property and its measurement by Guoy balance method, Applications of optical activity, dipole moment and magnetic property for determination of structure of molecule.

V Nano Material 07 Hrs.

Introduction to nano-materials Methods of Synthesis - i) High energy ball milling, ii) Physical vapour deposition (PVD) iii) Chemical vapour deposition (CVD) iv) Micro emulsion. Synthesis using micro-organisms and plant extract.

B. SC. THIRD YEAR
Paper XIV Organic Chemistry [Vth Semester]
45 Hrs. (3 Hrs/week)

I Spectroscopy 16 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, 2, 2 tribromoethane, ethyl acetate, toluene and Acetophenone. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques. (Combine and single λ max using woodwordfischer rule)

II Organometallic Compounds 08 Hrs.

Organomagnesium - compounds: Alkyl Magnesium halides-ethyl magnesium bromide formation, structure and chemical reactions. Organozinc compounddialkyl zinc formation and chemical reactions, organolithium compound- nbutyllithium formation and chemical reactions.

III Organic Synthesis via Enolates. 13 Hrs.

Defination, Active methylene compounds, Preparation of Aceto acetic ester, (Claisen condensation with Mechanism), Acidity of alpha hydrogen, properties and reactions involving formation of mono, di and unsaturated carboxylic acids, also synthesis of ketone, di ketone, 4-methyl uracil from acetoacetic ester, ketoenol tautomerism. Preparation of diethyl malonate, properties and reactions involved in alkylation, formation of mono, di and unsaturated carboxylic acids, and also synthesis of aminoacid and barbituric acids from diethyl malonate.

IV Fats, oils and detergents 08 Hrs.

Natural fats, edible and industrial oils of vegetable origin, manufacture of soyabean oil by solvent extraction method and isolation and uses of essential oils.

Types of animals fats and oils and defination of saponification value, iodine value, and acid value. Detergents: Defination, Introduction and preparation of sodium alkyl sulphonate, alkyl benzene sulphonate, and amide sulphonate, (one example each), Cleansing action of detergent.

B. SC. THIRD YEAR
Semester V Paper XV
Organic Chemistry
Lab Course: V Marks: 50

Binary Mixture:

Separation and Identification of both components

i) Benzoic Acid + β-naphthol
ii) Salicylic Acid + P- nitro aniline
iii) β-naphthol + Acetanilide
iv) m-nitroaniline + Naphthalene
v) α-naphthol + O-nitroaniline
vi) Cinnamic Acid + Naphthalene
vii) Salicylic Acid + Naphthalene
viii) β-naphthol + m-dinitrobenzene
ix) Cinnamic Acid + P- nitro aniline
x) Salicylic Acid + β-naphthol

Inorganic Chemistry
Lab Course: V Marks : 50

1 Inorganic Qualitative Analysis (Semi-Micro Analysis)
(Atleast five mixtures)
2. Separation of calcium and Barium and estimation of

Ca-volumetrically .
3. Separation of Cu and Ni from binary mixture solution and estimation of Cu-volumetrically .
4. Estimation of oxalic acid and H_2SO_4 in a given mixture Solution using NaOH and $KMnO_4$ solution.
5. Estimation of Fe by potassium dichromate using diphenyl ammine indicator.
6. Estimation of available chlorine in the given sample of bleaching powder.
7. Separation of calcium and Barium and estimation of Ba-gravimetically.
8. Separation of Cu and Ni from binary mixture solution and estimation of Ni-gravimetrically

B. SC. THIRD YEAR
Paper XVI Inorganic Chemistry [VIth Semester]
45 Hrs. (3 Hrs/week)
1. Metal-Ligand Bonding in Transition Metal Complexes 12 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 Crystal Field Parameters
2. Electronic Spectra of Transition Metal Complexes 7 Hrs
Types of Electronic Transitions
Selection rules for d -d transitions
Spectro -chemical series
Orgel Energy level diagram for d_1, d_5 and d_9
Electronic Spectrum of $[Ti(H_2O)6]^{3+}$ complex ion.
3. **Organometallic Compounds 10 Hrs**
Definition, Nomenclature and classification of Organometallic Compounds
Preparation, Properties, Bonding and Applications of alkyls and aryls of - Li, Al, Hg, Sn and Ti.
A Brief account of metal - ethylenic Complexes
Nature of bonding in metal carbonyls.
4. Bioinorganic Chemistry 10 Hrs
Essential and trace elements in biological processes
Metalloporphyrins with special reference to hemoglobin and myoglobin
Biological role of alkali (Na^+, K^+) and alkaline earth metal ions(Mg^{2+}, Ca^{2+}).
Nitrogen fixation
5. Chromatography 06 Hrs
Definition and classification of chromatography
Paper and Thin Layer Chromatography
Method of Development (Ascending, Descending Chromatography)
Locating Technique (UV-light / Chemicals)
R f value
Comparison between paper and TLC
Applications.

B. SC. THIRD YEAR

Paper XVII Organic Chemistry [VIth Semester]
45 Hrs. (3 Hrs/week)

1. Heterocyclic Compounds 13 Hrs.

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine, Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine. Comparison of basicity of pyridine, piperidine and pyrrole. Condensed Heterocyles: Introduction, Preparation of Quinoline (Skraups Synthesis), Isoquinoline (Bischler - Napirlaski) and Indole (Fischer indole Synthesis).

2. Carbohydrates 10 Hrs.

Defination, Introduction and Classification.
Monsaccharides-Interconversion of Glucose and Fructose, chain lengthening, chain shortening of aldoses. Conversion of Glucose in to mannose. Determination of openchain structure of glucose & pyranose ring structure of glucose . Mechanism of Mutarotation and Introduction to disaccharides (maltose, sucrose and lactose) and
Polysaccharides (Starch and cellulose) without involving structure determination.

3. Synthetic Polymers. 07 Hrs.

Introduction, Classification based on nature of synthesis (without mechanism) with examples. (Addition and condensation polymers). Properties, uses and synthesis of polyvinyl chloride, polyvinyl acetate, polystyrene, polyacrylonitrile, Nylon 6, Nylon 66. Introduction to synthetic and natural rubber, properties, uses and synthesis of Buna N., Neoprene and silicon rubber.

4. Synthetic Dyes and Drugs 15 Hrs.

Synthetic Dyes - Definition, colour and constitution (electronic concept) of dye, classification based on chemical constitution, synthesis of methyl orange, Congo red, malachite green, crystal violet, Alizarin and indigo dyes.
Synthetic Drugs - Defination, introduction, classification of drugs. Properties of ideal drug. Synthesis of chloromycetien,paracetamol,phenacetien, sulphaguainidine.

B. SC. THIRD YEAR
Semester VI Paper XVIII
Organic Chemistry
Lab Course: VI Marks: 50
Organic Estimation

i) Estimation of Carbonyl group by hydrazone formation method
ii) Estimation of vitamin C in commercial soft drink / Glucon D
iii) Estimation of ascorbic acid
iv) Estimation of Saponification value of oil

Organic Preparation and its purity by TLC

i) Preparation of Hydrazobenzene from azobenzene.
ii) Preparation of Phthalic anhydride from phthalic acid.
iii) Preparation of 2, 4 dinitrophenyl hydrazone of acetone.
iv) To prepare picrate of Naphthalene.
v) To prepare picrate of Anthracene**.**
Vi) preparation of p – bromo acetanilide from acetanilide

Physical Chemistry
Lab Course: VI Marks: 50
Instrumental
1. Determine the Strength of HCl and CH_3COOH in a
given mixture by titrating against strong base conductometrically.
2. Determine the strength of oxalic acid conductometrically
using sodium hydroxide solution.
3. To determine empirical formula of ferric -5-sulphosalicylate
4. Determine the amount of Fe^{2+} in the given solution potentiometrically
5. To determine the refractive indices of series of salt solutions and to find out
concentration of the salt in given unknown solution.
Non-Instrumental
1. To determine the interfacial tension between two immiscible
liquids.
2. To study the effect of addition of an electrolyte NaCl / KCl
on the solubility of benzoic acid at room temperature.
3. To determine the standard free energy change ΔG^0 and
equilibrium constant for the reaction.
$Cu + 2\ Ag^+ = Cu^{+2} + 2\ Ag$