

Table-8: B.Sc., SEMESTER – II

Sno	Course	Total Marks	Mid Sem Exam	Sem End Exam	Teaching Hours	Credits
1	First Language (Tel/Hin/Urdu/Sans...)	100	25	75	4	3
2	Second Language English	100	25	75	4	3
3	<i>Foundation course - 3</i> Environmental Sci	50	0	50	2	2
4	<i>Foundation course – 4A</i> ICT – 1 (Information & Communication Technol)	50	0	50	2	2
5	DSC* 1 B (Group Sub- 1)	100	25	75	4	3
6	DSC 1 B Lab Practical	50	0	50	2	2
7	DSC 2 B (Group Sub- 2)	100	25	75	4	3
8	DSC 2 B Lab Practical	50	0	50	2	2
9	DSC 3 B (Group Sub- 3)	100	25	75	4	3
10	DSC 3 B Lab Practical	50	0	50	2	2
	Total	750	-	-	30	25

B.Sc. Table-9: B.Sc., SEMESTER – III

Sno	Course	Total Marks	Mid Sem Exam	Sem End Exam	Teaching Hours	Credits
1	First Language (Tel/Hin/Urdu/Sans...)	100	25	75	4	3
2	Second Language English	100	25	75	4	3
3	<i>Foundation Course - 5</i> Entrepreneurship	50	0	50	2	2
4	<i>Foundation course -2B</i> Communication & Soft Skills -2	50	0	50	2	2
5	DSC 1 C (Group Sub- 1)	100	25	75	4	3
6	DSC 1 C Practical	50	0	50	2	2
7	DSC 2 C (Group Sub- 2)	100	25	75	4	3
8	DSC 2 C Practical	50	0	50	2	2
9	DSC 3 C (Group Sub- 3)	100	25	75	4	3
10	DSC 3 C Practical	50	0	50	2	2
	Total	750	-	-	30	25

Table-10: B.Sc., SEMESTER – IV

Sno	Course	Total Marks	Mid Sem Exam*	Sem End Exam	Teaching Hours**	Credits
1	<i>Foundation Course – 2C*</i> Communication & Soft Skills -3	50	0	50	2	2
2	<i>Foundation Course – 6*</i> Analytical Skills	50	0	50	2	2
3	<i>Foundation Course - 7 **</i> CE (Citizenship Education)	50	0	50	2	2
4	<i>Foundation course – 4B</i> ICT – 2 (Information & Communication Technol)	50	0	50	2	2
5	DSC 1 D (Group Sub- 1)	100	25	75	4	3
6	DSC 1 D Lab Practical	50	0	50	2	2
7	DSC 2 D (Group Sub- 2)	100	25	75	4	3
8	DSC 2 D Lab Practical	50	0	50	2	2
9	DSC 3 D (Group Sub- 3)	100	25	75	4	3
10	DSC 3 D Lab Practical	50	0	50	2	2
	Total	750	-	-	30	25

\*To be taught by English Teachers (and partly by Maths/Stat Teachers)

\*\* To be taught by Telugu Teachers

**SEMESTER II**  
**Paper II (Physical & General Chemistry) 60 hrs (4 h / w)**

**PHYSICAL CHEMISTRY      30 hrs (2h / w)**

**UNIT-I**

**Solid state 10h**

Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. The law of symmetry. Definition of lattice point, space lattice, unit cell. Bravais lattices and crystal systems. X-ray diffraction and crystal structure. Bragg's law. Determination of crystal structure by Bragg's method. Indexing of planes and structure of NaCl and KCl crystals. Defects in crystals. Stoichiometric and non-stoichiometric defects.

**UNIT-II**

**1. Gaseous state      6 h**

Compression factors, deviation of real gases from ideal behavior. Vander Waal's equation of state. P-V Isotherms of real gases, Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. The vander Waal's equation and the critical state. Law of corresponding states. Relationship between critical constants and vander Waal's constants. Joule Thomson effect.

**2. Liquid state 4 h**

Structural differences between solids, liquids and gases. Liquid crystals, the mesomorphic state. Classification of liquid crystals into Smectic and Nematic. Differences between liquid crystal and solid/liquid. Application of liquid crystals as LCD devices.

**UNIT-III**

**Solutions      10h**

Liquid-liquid - ideal solutions, Raoult's law. Ideally dilute solutions, Henry's law. Non-ideal solutions. Vapour pressure - composition and vapour pressure- temperature curves. Azeotropes-HCl-H<sub>2</sub>O, ethanol-water systems and fractional distillation. Partially miscible liquids-phenol-water, trimethylamine-water, nicotine-water systems. Effect of impurity on consolute temperature. Immiscible liquids and steam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

## **GENERAL CHEMISTRY 30 hrs (2h / w)**

### **UNIT-IV**

#### **1. Surface chemistry 8 h**

Definition of colloids. Solids in liquids (sols), preparation, purification, properties - kinetic, optical, electrical. Stability of colloids, Hardy-Schulze law, protective colloid.

Liquids in liquids (emulsions) preparation, properties, uses. Liquids in solids (gels) preparation, uses.

Adsorption: Physical adsorption, chemisorption. Freundlich, Langmuir adsorption isotherms. Applications of adsorption

#### **2. Chemical Bonding 7h**

Valence bond theory, hybridization, VB theory as applied to  $\text{ClF}_3$ ,  $\text{Ni}(\text{CO})_4$ , Molecular orbital theory - LCAO method, construction of M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules ( $\text{N}_2$ ,  $\text{O}_2$ ,  $\text{CO}$  and  $\text{NO}$ ).

### **UNIT-V**

#### **Stereochemistry of carbon compounds 15 h**

Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae.

Optical isomerism: Optical activity- wave nature of light, plane polarised light, optical rotation and specific rotation.

Chiral molecules- definition and criteria (Symmetry elements)- Definition of enantiomers and diastereomers – Explanation of optical isomerism with examples Glyceraldehyde, Lactic acid, Alanine, Tartaric acid, 2,3-dibromopentane.

D,L and R,S configuration methods and E,Z- configuration with examples.

**LABORATORY COURSE -II**  
**Practical-II (At the end of Semester-II)30 hrs (2 h / w)**

**Qualitative inorganic analysis**

Analysis of mixture salt containing two anions and two cations (From two different groups) from the following:

**Anions:** Carbonate, sulphate, chloride, bromide, iodide, acetate, nitrate, borate, phosphate.

**Cations:** Lead, copper, iron, aluminum, zinc, manganese, calcium, strontium, barium, potassium and ammonium.

**List of Text Books**

1. Advanced physical chemistry by Gurudeep Raj
2. Advanced physical chemistry by Bahl and Tuli
3. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
4. Stereochemistry by P.S.Kelsi
5. Stereochemistry of Organic compounds by D. Nasipuri
6. Telugu Academy Textbook of Chemistry Vol- I (English medium)
7. Unified chemistry Vol- I by K.Ramarao and Y. R. Sharma (Kalyani Publishers)
8. Unified chemistry Vol- I by O.P.Agarwal

**List of Reference Books**

1. Principles of physical chemistry by Prutton and Marron
2. Solid State Chemistry and its applications by Anthony R. West
3. Text book of physical chemistry by K L Kapoor
4. Text book of physical chemistry by S Glasstone
5. Stereochemistry of Organic compounds by E L Eliel
6. Advanced Organic Chemistry by F A Carey and R J Sundberg

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5. Stereochemistry of Organic compounds by E L Eliel
6. Advanced Organic Chemistry by F A Carey and R J Sundberg

## SEMESTER III

### Paper III (INORGANIC & ORGANIC CHEMISTRY) 60 hrs (4 h / w)

#### INORGANIC CHEMISTRY 30 hrs (2h / w)

##### UNIT – I

#### 1. Chemistry of d-block elements: 9h

Characteristics of d-block elements with special reference to electronic configuration, variable valence, magnetic properties, catalytic properties and ability to form complexes. Stability of various oxidation states

#### 2. Theories of bonding in metals:6h

Metallic properties and its limitations, Valence bond theory, , Free electron theory, Explanation of thermal and electrical conductivity of metals, limitations, Band theory, formation of bands, explanation of conductors, semiconductors and insulators.

##### UNIT – II

#### 3.Metal carbonyls and related compounds: 7h

EAN rule, classification of metal carbonyls, structures and shapes of metal carbonyls of V, Cr, Mn, Fe, Co and Ni.

#### 4. Chemistry of f-block elements: 8h

Chemistry of lanthanides - electronic structure, oxidation states, lanthanide contraction, consequences of lanthanide contraction, magnetic properties. Chemistry of actinides - electronic configuration, oxidation states, actinide contraction, comparison of lanthanides and actinides.

#### ORGANIC CHEMISTRY 30 h (2h/w)

##### UNIT – III

#### 1. Halogen compounds 5 h

Nomenclature and classification of alkyl (into primary, secondary, tertiary), aryl, aryl alkyl, allyl, vinyl, benzyl halides.

Nucleophilic aliphatic substitution reaction- classification into  $SN^1$  and  $SN^2$  – reaction mechanism with examples – Ethyl chloride, t-butyl chloride and optically active alkyl halide 2-bromobutane.



## 2. Hydroxy compounds

5 h

Nomenclature and classification of hydroxy compounds.

Alcohols: Preparation with hydroboration reaction, Grignard synthesis of alcohols.

Phenols: Preparation i) from diazonium salt, ii) from aryl sulphonates, iii) from cumene.

Physical properties- Hydrogen bonding (intermolecular and intramolecular). Effect of hydrogen bonding on boiling point and solubility in water.

Identification of alcohols by oxidation with  $\text{KMnO}_4$ , Ceric ammonium nitrate, Lucas reagent and phenols by reaction with  $\text{FeCl}_3$ .

Chemical properties:

a) Dehydration of alcohols.

b) Oxidation of alcohols by  $\text{CrO}_3$ ,  $\text{KMnO}_4$ .

c) Special reaction of phenols: Bromination, Kolbe-Schmidt reaction, Reimer-Tiemann reaction, Fries rearrangement, azocoupling, Pinacol-Pinacolone rearrangement.

## UNIT-IV

### Carbonyl compounds 10 h

Nomenclature of aliphatic and aromatic carbonyl compounds, structure of the carbonyl group.

Synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties: Reactivity of carbonyl group in aldehydes and ketones.

Nucleophilic addition reaction with a)  $\text{NaHSO}_3$ , b)  $\text{HCN}$ , c)  $\text{RMgX}$ , d)  $\text{NH}_2\text{OH}$ , e)  $\text{PhNHNH}_2$ , f) 2,4-DNPH, g) Alcohols-formation of hemiacetal and acetal.

Base catalysed reactions: a) Aldol, b) Cannizzaro reaction, c) Perkin reaction, d) Benzoin condensation, e) Haloform reaction, f) Knoevenagel reaction.

Oxidation of aldehydes- Baeyer-Villiger oxidation of ketones.

Reduction: Clemmensen reduction, Wolf-Kishner reduction, MPV reduction, reduction with  $\text{LiAlH}_4$  and  $\text{NaBH}_4$ .

Analysis of aldehydes and ketones with a) 2,4-DNT test, b) Tollen's test, c) Fehling test, d) Schiff's test, e) Haloform test (with equation)

## UNIT-V

### 1. Carboxylic acids and derivatives 6 h

Nomenclature, classification and structure of carboxylic acids.

Methods of preparation by

a) Hydrolysis of nitriles, amides

b) Hydrolysis of esters by acids and bases with mechanism

c) Carbonation of Grignard reagents.

Special methods of preparation of aromatic acids by

- a) Oxidation of side chain.
- b) Hydrolysis by benzotrichlorides.
- c) Kolbe reaction.

**Physical properties:** Hydrogen bonding, dimeric association, acidity- strength of acids with examples of trimethyl acetic acid and trichloroacetic acid. Relative differences in the acidities of aromatic and aliphatic acids.

**Chemical properties:** Reactions involving H, OH and COOH groups- salt formation, anhydride formation, acid chloride formation, amide formation and esterification (mechanism). Degradation of carboxylic acids by Huns-Diecker reaction, decarboxylation by Schimdt reaction, Arndt-Eistert synthesis, halogenation by Hell-Volhard- Zelinsky reaction.

## 2. Active methylene compounds<sup>4 h</sup>

**Acetoacetic esters:** keto-enol tautomerism, preparation by Claisen condensation, Acid hydrolysis and ketonic hydrolysis.

Preparation of a) monocarboxylic acids.

b) Dicarboxylic acids.

Reaction with urea

**Malonic ester:** preparation from acetic acid.

**Synthetic applications:** Preparation of

- a) monocarboxylic acids (propionic acid and n-butyric acid).
- b) Dicarboxylic acids (succinic acid and adipic acid)
- c)  $\alpha,\beta$ -unsaturated carboxylic acids (crotonic acid).

Reaction with urea.



## SEMESTER IV

### Paper IV (SPECTROSCOPY & PHYSICAL CHEMISTRY) 60 hrs (4 h / w)

#### SPECTROSCOPY 30 hrs (2h / w)

##### UNIT-I

##### Molecular Spectroscopy

##### 1. Electronic spectroscopy: 8h

Interaction of electromagnetic radiation with molecules and types of molecular spectra. Energy levels of molecular orbitals ( $\sigma$ ,  $\pi$ ,  $n$ ). Selection rules for electronic spectra. Types of electronic transitions in molecules effect of conjugation. Concept of chromophore and auxochrome.

##### 2. Infra red spectroscopy 8h

Different Regions in Infrared radiations. Modes of vibrations in diatomic and polyatomic molecules. Characteristic absorption bands of various functional groups. Interpretation of spectra-Alkanes, Aromatic, Alcohols carbonyls, and amines with one example to each.

##### 3. Proton magnetic resonance spectroscopy ( $^1\text{H-NMR}$ ) 8h

Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals - spin-spin coupling, coupling constants. Applications of NMR with suitable examples - ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate, toluene and acetophenone.

##### UNIT-II

##### Spectrophotometry 6h

General features of absorption - spectroscopy, Beer-Lambert's law and its limitations, transmittance, Absorbance, and molar absorptivity. Single and double beam spectrophotometers. Application of Beer-Lambert law for quantitative analysis of

1. Chromium in  $\text{K}_2\text{Cr}_2\text{O}_7$
2. Manganese in manganous sulphate

##### PHYSICAL CHEMISTRY 30 hrs (2h / w)

##### UNIT-III

##### Dilute solutions 10h

Colligative properties. Raoult's law, relative lowering of vapour pressure, its relation to molecular weight of non-volatile solute. Elevation of boiling point and depression of freezing point. Derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods of determination. Osmosis, osmotic pressure, experimental determination. Theory of dilute solutions. Determination of molecular weight of non-volatile solute from osmotic pressure. Abnormal Colligative properties

## UNIT-IV

### Electrochemistry-I10h

Specific conductance, equivalent conductance. Variation of equivalent conductance with dilution. Migration of ions, Kohlrausch's law. Arrhenius theory of electrolyte dissociation and its limitations. Ostwald's dilution law. Debye-Huckel-Onsagar's equation for strong electrolytes (elementary treatment only). Definition of transport number, determination by Hittorfs method. Application of conductivity measurements- conductometric titrations. Types of reversible electrodes- the gas electrode, metal-metal ion, metal-insoluble salt and redox electrodes. Electrode reactions, Nernst equation, single electrode potential,

## UNIT-V

### 1. Electrochemistry-II4h

Standard Hydrogen electrode, reference electrodes, standard electrode potential, sign convention, electrochemical series and its significance. Reversible and irreversible cells, conventional representation of electrochemical cells. EMF of a cell and its measurements. Computation of cell EMF. Applications of EMF measurements - Potentiometric titrations.

### 2.Phase rule

6h

Concept of phase, components, degree of freedom. Derivation of Gibbs phase rule. Phase equilibrium of one component - water system. Phase equilibrium of two- component system, solid-liquid equilibrium. Simple eutectic diagram of Pb-Ag system, desilverisation of lead. Freezing mixtures.

**LABORATORY COURSE – IV**  
**Practical Paper - IV (at the end of semester IV)**

**30 hrs (2 h / W)**

**25M**

**Physical Chemistry**

1. Critical Solution Temperature
2. Effect of NaCl on critical solution temperature
3. Determination of concentration of HCl conductometrically using standard NaOH solution.
4. Determination of concentration of acetic acid conductometrically using standard NaOH Solution.

**IR Spectral Analysis**

**25 M**

5. IR Spectral Analysis of the following functional groups with examples
  - a) Hydroxyl groups
  - b) Carbonyl groups
  - c) Amino groups
  - d) Aromatic groups

**List of Text Books**

1. Advanced physical chemistry by Guru deep Raj
2. Introduction to Electrochemistry by S. Glasstone
3. Elementary organic spectroscopy by Y.R. Sharma
4. Spectroscopy by P.S.Kelsi
4. Unified chemistry Vol- II by O.P. Agarwal
5. Unified chemistry Vol- II by K. Ramarao and Y. R. Sharma (Kalyani Publishers)

**List of Reference Books**

1. Spectroscopy by William Kemp
2. Spectroscopy by Pavia
3. Organic Spectroscopy by J. R. Dyer
4. Modern Electrochemistry by J.O. M. Bockris and A.K.N.Reddy
5. Advanced Physical Chemistry by Atkins

