

Andhra Pradesh State Council of Higher Education
 B.Sc. Chemistry Syllabus under CBCS
 w.e.f. 2015-16 (revised in April 2016)

Structure of Chemistry Syllabus Under CBCS

YEAR	SEMESTER	PAPER	TITLE	MARKS	CREDITS	
I	I	I	Inorganic and Organic Chemistry	100	03	
			Practical – I	50	02	
	II	II	Physical and General Chemistry	100	03	
			Practical – II	50	02	
II	III	III	Inorganic and organic Chemistry	100	03	
			Practical – III	50	02	
	IV	IV	Spectroscopy and Physical Chemistry	100	03	
			Practical – IV	50	02	
III	V	V	Inorganic ,Organic and Physical Chemistry	100	03	
			Practical – V	50	02	
		VI	VI	Inorganic ,Organic and Physical Chemistry	100	03
				Practical – VI	50	02
	* Any one Paper from VII A, B and C	VII (A)*	VII (A)*	Elective	100	03
				Practical - VII A	50	02
		VII (B)*	VII (B)*	Elective	100	03
				Practical - VII B	50	02
		VII (C)*	VII (C)*	Elective	100	03
				Practical - VII C	50	02
	** Any one cluster from VIII, A, B and C	VIII (A)**	VIII (A)**	Cluster Electives - I :	100	03
				VIII-A-1	100	03
				VIII-A-2	100	03
				VIII-A-3	50	02
					50	02
					50	02
		VIII (B)**	VIII (B)**	Cluster Electives - II ::	100	03
				VIII-B-1	100	03
VIII- B-2				100	03	
VIII-B-3				50	02	
				50	02	
				50	02	
VI	VIII (C)**	VIII (C)**	Cluster Electives - III ::	100	03	
			VIII-C-1	100	03	
			VIII-C-2	100	03	
			VIII-C-3	50	02	
				50	02	
				50	02	

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 :

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 KMnO_4 , Ceric ammonium nitrate, Luca's reagent and phenols by reaction with FeCl_3 .

Chemical properties:

- Dehydration of alcohols.
- Oxidation of alcohols by CrO_3 , KMnO_4 .
- Special reaction of phenols: Bromination, Kolbe-Schmidt reaction, Riemer-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) NaHSO_3 , b) HCN , c) RMgX , d) NH_2OH , e) PhNHNH_2 , f) 2,4 DNPH, g) Alcohols-formation of hemiacetal and acetal. Base catalysed reactions: a) Aldol, b) Cannizzaro's 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 LiAlH_4 and NaBH_4 . Analysis of aldehydes and ketones with a) 2,4-DNPH 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

4 h

Acetoacetic ester: keto-enol tautomerism, preparation by Claisen condensation, Acid hydrolysis and ketonic hydrolysis. Preparation of a) monocarboxylic acids. b) Dicarboxylic acids. c) 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) α,β -unsaturated carboxylic acids (crotonic acid). d) Reaction with urea.

List of Reference Books

1. Selected topics in inorganic chemistry by W.D.Malik, G..D.Tuli,R.D.Madan
2. Inorganic Chemistry J E Huheey, E A Keiter and R L Keiter
3. A Text Book of Organic Chemistry by Bahl and Arun bahl
4. A Text Book of Organic chemistry by I L Finar Vol I
5. Organic chemistry by Bruice
6. Organic chemistry by Clayden
7. Advanced Inorganic chemistry by Gurudeep Raj
8. Basic Inorganic Chemistry by Cotton and Wilkinson
9. Concise Inorganic Chemistry by J.D.Lee

LABORATORY COURSE -III

30 hrs. (2 h / w)

Practical Paper-III Titrimetric analysis and Organic Functional Group Reactions
(At the end of Semester-III)

Record-10, Experiment-40=Total 50

Titrimetric analysis: 20M

1. Determination of Fe (II) using KMnO_4 with oxalic acid as primary standard.
2. Determination of Cu(II) using $\text{Na}_2\text{S}_2\text{O}_3$ with $\text{K}_2\text{Cr}_2\text{O}_7$ as primary standard.

Organic Functional Group Reactions 20M

3. Reactions of the following functional groups present in organic compounds (at least four) Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids and Amides

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

SPECTROSCOPY

30 hrs (2h / w)

UNIT-I

6h

General features of absorption - 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 $K_2Cr_2O_7$
2. Manganese in Manganous sulphate

Electronic spectroscopy:

8h

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

UNIT-II

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.

Proton magnetic resonance spectroscopy (1H -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.

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- Van't Hoff factor.

UNIT-IV

Electrochemistry-I

10h

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.

UNIT-V

1. Electrochemistry-II

4h

Single electrode potential, sign convention, Reversible and irreversible cells Nernst Equation- Reference electrode, Standard Hydrogen electrode, calomel electrode, Indicator electrode, metal – metal ion electrode, Inert electrode, Determination of EMF of cell, Applications of EMF measurements - Potentiometric titrations.

2.Phase rule

6h

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

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
6. Introduction to Electrochemistry by S. Glasstone
7. Elementary organic spectroscopy by Y.R. Sharma
8. Spectroscopy by P.S.Kalsi

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LABORATORY COURSE – IV
Practical Paper - IV Physical Chemistry and IR Spectral Analysis
(at the end of semester IV)

30 hrs (2 h / W)

Record-10, Experiment-40=Total 50

Physical Chemistry

20M

1. Critical Solution Temperature- Phenol-Water system
2. Effect of NaCl on critical solution temperature (Phenol-Water system)
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

20 M

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

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SRI VENKATESWARA UNIVERSITY

Model Question paper for **3rd Semester** of **B.Sc** degree course from the academic year **2016-17**

Name of the Subject: **CHEMISTRY**

Max.Marks:75

Section - I

Answer any **Five** of the following:

5x5=25

1. Write notes on catalytic properties of d-block elements.
2. Write a note on semi conductors
3. State and explain EAN rule.
4. Compare lanthanides and actinides.
5. Alkyl halides are more reactive than Vinyl halides. Explain
6. Explain Pinacol-Pinacolone rearrangement
7. Explain Perkin reaction
8. How acetoacetic ester is prepared?

Section - II

Answer **All** the Questions

10x5=50

9. a) Explain the stability of variable oxidation states and complex formation of transition on elements
(OR)
b) Explain Valence bond theory of metals. How does it explains the metallic properties
10. a) What are metal Carbonyls? Explain the structures of $\text{Ni}(\text{CO})_4$ and $\text{Fe}(\text{CO})_5$
(OR)
b) Explain the causes and consequences of lanthanide contraction.
11. a) Explain the mechanism of S_N^1 and S_N^2 reactions in alkyl halides
(OR)
b) Write any three methods of preparation of phenols. Explain the acidic nature of phenols.
12. a) Explain the following reactions with mechanism
i) Benzoin Condensation. ii) Clemensen reduction
(OR)
b) Write any three methods of preparation of aldehydes and Ketones. How aldehydes and Ketones are distinguished?
13. a) Write any two methods of preparation of carboxylic acids.
ii) Why chloro acetic acid is stronger than acetic acid
(OR)
b) Explain the synthesis of following compounds from malonic ester
i) Propionic acid. ii) Succinic acid. ii) Crotonic acid.

Sri Venkateswara University

Model Question paper for 4th semester of B.Sc degree course from the academic year 2016-17

Name of the Subject: **CHEMISTRY**

Max.Marks:75

Section-I

Answer any **Five** of the following:

5x5=25

1. Write notes on chromophores.
2. Write a note on finger print region.
3. What is coupling constant and explain its significance.
4. Explain the terms: (a) Absorbance (b) Transmittance.
5. Explain Raoult's law.
6. Explain molar conductivity and equivalent conductivity.
7. Write a note on calomel electrode.
8. Write short notes on eutectic point.

Section-II

Answer **All** the question:

10x5=50

9. a) What is chemical shift? Write the factors affecting chemical shift?
(OR)
b) Explain principles of IR spectroscopy.
10. a) State and explain Beer-Lambert's law. Explain any two of its applications.
(OR)
b) Explain different types of spectrophotometers with schematic diagrams.
11. a) Define osmotic pressure? How is it determined using Berkeley-Hartley method.
(OR)
b) How molecular weight can be determined by depression in freezing point using Beckmann's method
12. a) Explain Kohlraush law and its applications.
(OR)
b) Define transport number? How it can be determined by Hittorf's method.
13. a) Define phase rule? Explain the phase diagram of water system.
(OR)
b) Explain the terms involved in phase rule.