

REVISED SYLLABUS OF B.Sc. Chemistry  
UNDER CBCS / SEMESTER SYSTEM FRAMEWORK  
WITH EFFECT FROM 2020-2021 ADMITTED BATCH

PROGRAMME : THREE-YEAR B.Sc.  
Subject : CHEMISTRY

COURSES STRUCTURE: SECOND YEAR SEMESTER - IV from A.Y 2021-22

Year	Semester	Paper Part-II	Subject	Hours /week	Credits	IA	EA	Total
2nd Year	IV Semester	Course-IV	Inorganic, Organic And Physical Chemistry	4	3	25	75	100
		Course-IV Practical	Organic Qualitative analysis	3	2	Max. Marks-50 Internal assessment at Semester end		50
		Course-V	Inorganic & Physical Chemistry	4	3	25	75	100
		Course-V Practical	Conductometric and Potentiometric Titrimetry	3	2	Max. Marks-50 External assessment at Semester end		50

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**Course outcomes:**

At the end of the course, the student will be able to;

1. To learn about the laws of absorption of light energy by molecules and the subsequent photo chemical reactions.
2. To understand the concept of quantum efficiency and mechanisms of photochemical reactions.

**UNIT - I : ORGANO METALLIC COMPOUNDS**

8h

Definition and classification of organo metallic

Compounds on the basis of bond type, Concept of hapticity of organic ligands.

Metal carbonyls: 18 electron rule, electron count of mononuclear, poly nuclear and substituted metal carbonyls of 3d series. General methods of preparation of mono and binuclear carbonyls of 3d series. Structures and Shapes of Metal carbonyls of V, Cr, Mn, Fe and Co

**UNIT - II : CARBOHYDRATES**

8h

Occurrence, classification and their biological importance, Monosaccharide's: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Inter conversions of aldoses and ketoses; Killiani-Fischer synthesis and Ruff degradation;

**UNIT- III : AMINO ACIDS AND PROTEINS**

6h

Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples - Glycine, Alanine, valine and leucine) by following methods: a) from halogenated carboxylic acid b) Gabriel Phthalimide synthesis c) strecker's synthesis.

Physical properties: Zwitter ion structure - salt like character - solubility, melting

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points, amphoteric character, definition of isoelectric point.

Chemical properties: General reactions due to amino and carboxyl groups - lactams from gamma and delta amino acids by heating- peptide bond (amide linkage).

### **Heterocyclic Compounds**

**7h**

Introduction and definition: Simple five membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole - Aromatic character - Preparation from 1, 4, -dicarbonyl compounds, Paul-Knorr synthesis.

Properties: Acidic character of pyrrole - electrophilic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions - Diels Alder reaction in furan.

Pyridine - Structure - Basicity - Aromaticity- Comparison with pyrrole- one method of preparation and properties - Reactivity towards Nucleophilic substitution reaction.

### **UNIT- IV: Nitrogen Containing Functional Groups**

Preparation, properties and important reactions of nitro compounds, amines and diazonium salts.

#### **1. Nitro hydrocarbons**

**3h**

Nomenclature and classification-nitro hydrocarbons, structure -Tautomerism of nitro alkanes leading to aci and keto form, Preparation of Nitro alkanes, (Gabriel Phthalimide synthesis, Hoffmann- Bromamide reaction) reactivity -halogenation, reaction with HONO (Nitrous acid), Nef reaction and Mannich reaction leading to Micheal addition and reduction.

#### **2. Amines:**

**11h**

Introduction, classification, chirality in amines (pyramidal inversion), importance and general methods of preparation.

Properties: Physical properties, Basicity of amines: Effect of substituent, solvent and Steric effects. Chemical properties, Distinction between Primary, Secondary and tertiary amines using Hinsberg's method and nitrous acid. Difference between Primary, Secondary and tertiary amines Discussion of the following reactions with emphasis on the mechanistic pathway: Hoffmann's exhaustive methylation, Hofmann-elimination reaction and Cope elimination.

#### **3. Diazonium salts :** preparation and properties of Diazonium salts.

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## UNIT- V : PHOTOCHEMISTRY

5h

Difference between thermal and photochemical processes, Laws of photochemistry- Grothus- Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield- Photochemical reaction mechanism- hydrogen- chlorine and hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, Jablonski diagram, Photosensitized reactions- energy transfer processes (simple example).

### Thermodynamics

12 h

The first law of thermodynamics-statement, definition of internal energy and enthalpy, Heat capacities and their relationship, Joule-Thomson effect-coefficient, Calculation of work for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes, State function. Temperature dependence of enthalpy of formation- Kirchoff s equation, Second law of thermodynamics Different Statements of the law, Carnot cycle and its efficiency, Carnot theorem, Concept of entropy, entropy as a state function, entropy changes in reversible and irreversible processes. Entropy changes in spontaneous and equilibrium processes.

**Co-curricular activities and Assessment Methods** Continuous Evaluation: Monitoring the progress of student's learning Class Tests, Worksheets and Quizzes Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality  
Semester- end Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

### List of Reference Books

1. Concise coordination chemistry by Gopalan and Ramalingam
2. Coordination Chemistry by Basalo and Johnson
3. Organic Chemistry by G.Mareloudan, Purdue Univ
4. Text book of physical chemistry by S Glasstone
6. Concise Inorganic Chemistry by J.D.Lee
7. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
8. A Text Book of Organic Chemistry by Bahl and Arunbahl
9. A Text Book of Organic chemistry by I L Finar Vol I
10. A Text Book of Organic chemistry by I L Finar Vol II
11. Advanced physical chemistry by Gurudeep Raj

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**ACHARYANAGARJUNA UNIVERSITY :: NAGARJUNA NAGAR – 522 510**  
**REVISED UG SYLLABUS UNDER CBCS (Implemented from Academic Year, 2020-21)**  
**Course: B.Sc. CHEMISTRY**

MODEL PAPER

SECOND YEAR B.Sc., DEGREE EXAMINATION

SEMESTER-IV

COURSE – IV : INORGANIC, ORGANIC & PHYSICAL CHEMISTRY

Time: 3 hours

Maximum Marks: 75

PART- A

5 X 5 = 25

Marks

Answer any FIVE of the following questions. Each carries FIVE marks

1. Describe the 18 electron rule of mono nuclear and polynuclear metal carbonyls with suitable examples.
2. What are epimers and anomers. Give examples.
3. Discuss about iso electric point and zwitter ion.
4. Discuss the Paul-Knorr synthesis of five membered heterocyclic compounds.
5. Explain Tautomerism shown by nitro alkanes
6. Discuss the basic nature of amines.
7. Write the differences between thermal and photochemical reactions.
8. Derive heat capacities and derive  $C_p - C_v = R$

PART- B

5 X 10 = 50 Marks

Answer any FIVE of the following questions. Each carries Ten marks

9. What are organometallic compounds? Discuss their Classification on the basis of type of bonds with examples.
10. Discuss the general methods of preparations of mono & bi-nuclear carbonyl of 3d series.
11. Discuss the constitution, configuration and ring size of glucose. Draw the Haworth and Conformational structure of glucose.
12. (i) Explain Ruff's degradation.  
(ii) Explain Kiliani- Fischer synthesis.
13. What are amino acids? Write any three general methods of preparation of amino acids.
14. Discuss the aromatic character of Furan, Thiophene and Pyrrole.
15. Write the mechanism for the following.  
(i) Nef reaction  
(ii) Mannich reaction
16. (i) Explain Hinsberg separation of amines.  
(ii) Discuss any three synthetic applications of diazonium salts.
17. What is quantum yield? Explain the photochemical combination of Hydrogen-Chlorine and Hydrogen - Bromine.
18. Define entropy. Describe entropy changes in the reversible and irreversible process.

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**ACHARYA NAGARJUNA UNIVERSITY :: NAGARJUNANAGAR-522 510**

**First Year B.Sc. CHEMISTRY SYLLABUS**

**SEMESTER - IV**

**Paper - V : INORGANIC & PHYSICAL CHEMISTRY**

**60 hrs (4 h / w)**

**Course outcomes:**

At the end of the course, the student will be able to;

1. Understand concepts of boundary conditions and quantization, probability distribution, most probable values, uncertainty and expectation values
2. Application of quantization to spectroscopy.
3. Various types of spectra and their use in structure determination.

**INORGANIC CHEMISTRY**

**26h**

**UNIT - I : Coordination Chemistry**

**12h**

IUPAC nomenclature of coordination compounds, Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Valence Bond Theory (VBT): Inner and outer orbital complexes. Limitations of VBT, Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry, Factors affecting the magnitude of crystal field splitting energy, Spectrochemical series, Comparison of CFSE for Octahedral and Tetrahedral complexes.

**UNIT -II**

**1. Inorganic Reaction Mechanism:**

**4h**

Introduction to inorganic reaction mechanisms. Concept of reaction pathways, transition state, intermediate and activated complex. Labile and inert complexes, ligand substitution reactions -  $SN^1$  and  $SN^2$ , Substitution reactions in square planar complexes, Trans-effect, theories of trans effect and its applications

**2. Stability of metal complexes:**

**2h**

Thermodynamic stability and kinetic stability, factors affecting the stability of metal complexes, chelate effect, determination of composition of complex by Job's method and mole ratio method.

**Bioinorganic Chemistry:**

**8h**

Metal ions present in biological systems, classification of elements according to their action in biological system. Excess and deficiency of some trace metals.

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Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Iron and its application in bio-systems, Haemoglobin, Myoglobin.

## **PHYSICAL CHEMISTRY**

**34 h**

### **UNIT-III**

#### **1 .Phase rule**

**6h**

Concept of phase, components, degrees of freedom. Thermodynamic derivation of Gibbs phase rule. Phase diagram of one component system - water system, Study of Phase diagrams of Simple eutectic systems i) Pb-Ag system, desilverisation of lead ii) NaCl-Water system, Congruent and incongruent melting point- Definition and examples for systems having congruent and incongruent melting point , freezing mixtures.

### **UNIT-IV**

#### **Electrochemistry**

**14h**

Specific conductance, equivalent conductance and molar conductance- Definition and effect of dilution. Cell constant. Strong and weak electrolytes, Kohlrausch's law and its applications, Definition of transport number, determination of transport number by Hittorf's method. Debye - Huckel - Onsager's equation for strong electrolytes (elementary treatment only), Application of conductivity measurements- conductometric titrations.

Electrochemical Cells- Single electrode potential, Types of electrodes with examples: Metal- metal ion, Gas electrode, Inert electrode, Redox electrode, Metal-metal insoluble salt- salt anion. Determination of EMF of a cell, Nernst equation, Applications of EMF measurements  
- Potentiometric titrations.

### **UNIT-V**

#### **Chemical Kinetics:**

**14 h**

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction, Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half-life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation.

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8/7/22

## Co-curricular activities and Assessment Methods

Continuous Evaluation: Monitoring the progress of student's learning Class Tests, Worksheets and Quizzes Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality  
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3. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
4. Advanced physical chemistry by Gurudeep Raj
5. Principles of physical chemistry by Prutton and Marron
6. Advanced physical chemistry by Bahl and Tuli
7. Inorganic Chemistry by J.E.Huheey
8. Basic Inorganic Chemistry by Cotton and Wilkinson
9. A textbook of qualitative inorganic analysis by A.I. Vogel
10. Atkins, P.W. & Paula, J.deAtkin's Physical Chemistry Ed., Oxford University Press 10<sup>th</sup> Ed (2014).
11. Castellan, G.W. Physical Chemistry 4<sup>th</sup> Ed. Narosa (2004).
12. Mortimer, R. G. Physical Chemistry 3<sup>rd</sup> Ed. Elsevier: NOIDA, UP (2009).
13. Barrow, G.M. Physical Chemistry

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**Course: B.Sc. CHEMISTRY**

**MODEL PAPER**

**SECOND YEAR B.Sc., DEGREE EXAMINATION**

**SEMESTER-IV**

**COURSE -V: INORGANIC & PHYSICAL CHEMISTRY**

Time: 3 hours

Maximum Marks: 75

**PART- A**

5 X 5 = 25 Marks

Answer any FIVE of the following questions. Each carries FIVE marks

1. What is spectrochemical series.
2. Explain Labile & inert complexes.
3. Explain Job's method for determination of composition of complex.
4. Explain Thermodynamic derivation of Gibb's phase rule.
5. Explain any two conductometric titrations.
6. Explain Kohlraush's law with examples.
7. Write Arrhenius equation. Explain the terms.
8. Define order and molecularity of a reaction. Distinguish between them.

**PART- B**

5 X 10 = 50 Marks

Answer any FIVE of the following questions. Each carries Ten marks

9. Explain Valence Bond theory with Inner and Outer orbital complexes. Write limitations of VBT.
10. Define CFSE. Explain the factors effecting the magnitude of crystal field splitting energy.
11. Explain Trans effect. Write any two applications of trans effect.
12. Write the biological functions of Haemoglobin and Myoglobin.
13. Define Phase rule and terms involved in it. Explain phase diagram of Pb-Ag system.
14. (i) Explain phase diagram for NaCl-water system.  
(ii) Explain briefly about Freezing mixtures.
15. Define Transport number. Write experimental method for the determination of transport number by Hittorf method.
16. (i) Define single electrode potential.  
(ii) Explain four types of electrodes with examples.
17. Explain general methods for determination of order of a reaction.
18. Derive the rate equation for first order reaction and half-life-time of first order reaction.

*Antony*  
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