

**BHARATHIAR UNIVERSITY,COIMBATORE -641 046**

The syllabus for the following papers furnished below be followed for the candidates admitted from the Academic Year 2017-18 onwards and there is no change in the syllabi of remaining papers

**CORE I - CHEMISTRY PAPER I**

**(2017-18 batch for UG CHEMISTRY)**

Teaching hours : 60 hours per semester Subject Description : This paper presents the basic principles of Chemistry. Goals : To enable the students to learn about the basic principles of Chemistry. Objective : To understand the important concepts of Chemistry.

**UNIT- I**

- 1.Periodic table-Introduction-Periodic properties- Ionisationenergy,Electronaffinity,Electronegativity and their variations along the period and groups.
- 2.Hybridization and geometry of  $\text{BeCl}_2$ ,  $\text{BF}_3$ ,  $\text{CH}_4$ ,  $\text{PCl}_5$ ,  $\text{IF}_7$  and  $\text{SF}_6$ .VSEPR Theory. Covalent Bond-Molecular orbital theory-application tomolecules such as  $\text{H}_2^+$   $\text{He}_2$ , $\text{F}_2$ , $\text{O}_2$ , $\text{N}_2$ , $\text{CO}$  and  $\text{NO}$ .

**UNIT- II**

- 1.Nomenclature of acyclic alkane, alkene and alkyene.
- 2.Alkenes: Preparation by Wittig reaction – Mechanisms of beta elimination – E1, E2 and cis elimination – Hoffmann’s rule and Saytzeff’s rule. Addition reactions with hydrogen, halogen, hydrogen halide (Markownikoff’s rule) and hydrogen bromide (Peroxide effect).Dienes: Stability of isolated and conjugated dienes-1, 2 and 1, 4 additions, Diels -Alder reaction. Free Radical addition – Polymerization – synthetic rubber
- 3.Alkynes: Acidity of Alkynes – formation of acetylides-addition of water with  $\text{HgSO}_4$  catalyst-hydroboration

**UNIT- III.**

1. Polar effects – inductive effect, mesomeric effect, electromeric effect, hyper conjugation and steric effects. Classification of reagents: Electrophiles, Nucleophiles and Free radicals. Types of reaction: Polar reactions involving carbonium ions and carbanions with simple examples.
2. Aliphatic Hydrocarbons: Restricted rotation about single bond preferred rotationalconformations.
- 3.Cycloalkanes: Preparation by Dieckmann ring closure and by reduction of aromatic hydrocarbons – ring opening reactions of cyclopropane with  $\text{H}_2$ ,  $\text{Br}_2$  and  $\text{HI}$ .

## UNIT IV

1 Liquid crystals—the concept of mesomorphic state-typical liquid crystalline substances and their properties.

2.Failure of classical theory in explaining black body radiation- Planck's theory of quantization of energy – Einstein theory of photoelectric effect-Compton effect. deBroglie theory of wave-particle dualism . Particle in one dimensional box (Wave length determination only)

## UNIT V:

The laws of thermodynamics, generalities and Zeroth law – kinds of energy – Scope of the first and second laws of thermodynamics-thermodynamic terms-definitions – heat – work of expansion – work of compression – maximum and minimum quantities of work – Reversible and irreversible transformations of energy. First law of thermodynamics – properties of energy changes in relation to properties of system- isothermal and adiabatic changes – meaning of the thermodynamic state function – properties of exact and inexact differentials – Joule Thomson experiment

## CORE II - CHEMISTRY PAPER II

Teaching hours: 60 hours per semester Subject description: This paper presents the concept of coordination chemistry, aromaticity and thermodynamics. Goals: To enable the students to learn about acids and bases, aromaticity, and thermodynamics Objectives:To study the principles of acids and bases and thermodynamics.

## Unit- I

Acids and bases; Definitions- different approaches to protonic acid – base systems –strengths of Lewis Acids and Bases -Hard and Soft Acids and Bases.Applications of HSAB concept Basis of hardness and softness, limitations of HSAB concept.

## Unit- II:

Chemistry of Boron family – Group discussion – Electron acceptor behaviour and electron deficiency of boron hydrides; bonding in diboranes;  $\text{NaBH}_4$  and borazole - preparation, properties, structure and uses.

Silicates-Classification of silicate- simple silicates chain silicates and sheet silicates only.

## Unit III:

Structure of benzene-Aromaticity-Huckel's rule.Electrophilic substitution in benzene with mechanism. -Nucleophilic substitution reaction –  $\text{S}_{\text{N}}1$ ,  $\text{S}_{\text{N}}2$  and  $\text{S}_{\text{N}}\text{i}$  reactions – Grignard reagents and synthetic applications-Elimination versus substitution-Benzyne mechanism and intermediate complex mechanism.

Unit IV:

Relation between E and H, Cp and Cv. Application of the first law of thermodynamics to chemical reactions. The heat of reaction – conventions in the values of H. The determination of heats of formation – sequences of reactions.

Unit V:

Hess's law – heats of combustion – determination by Bomb Calorimeter – Bond energies – Resonance energies – Heats of solution – integral and differential heat of dilution – Heats of reaction at constant volume – dependence of the heat of reaction on temperature and Kirchoff's equation.

TEXTBOOKS FOR REFERENCE:

1. Principles of Inorganic Chemistry, B.R. Puri L.R. Sharma, ShobanlalNagin Chand & Co.
2. Inorganic Chemistry, P.L.Soni, Sultan Chand & Sons.
3. Organic Chemistry, Vol. 1, 2, 3, S. M. Mughergee, S.P. Singh, R.P. Kapoor, Wiley Eastern.
4. Advanced Organic Chemistry, B.S. Bahl, Arunbahl, S.Chand& Co.
5. Essentials of Physical Chemistry, B.S. Bahl and G.D. Tuli, S.Chand& Co.
6. Text book of Physical Chemistry, P.L.Soni, D.B. Dharmarke, Sultan Chand & Sons.
7. Physical chemistry, G. N. Castellan, Addison- Wesley Pub. Co.

## CORE IV - CHEMISTRY PAPER III

**Teaching hours: 45 hours per semester (3 hours per week)**

**Subject description:** This paper presents the principle in the extraction of metals and mechanism of some important organic reactions.

**Goals:** To enable the students to learn about the extraction principles and mechanism of some addition reaction.

**Objectives:** To understand the mechanism and synthetic uses of important organic reactions.

**Unit I:**

General methods of Extraction: Concentration – Gravity separation, Froth Floatations magnetic separation, Extraction – Chemical and Electrolytic methods of refining, Zone refining, Van Arkel refining and Electrolytic refining with examples. Occurrence, extraction, properties and uses of Germanium and Titanium - their important compounds such as  $\text{GeCl}_4$  and  $\text{TiO}_2$

**Unit II**

Chemistry of Carbonyl Compounds – I: Reaction mechanisms: Nucleophilic addition of Grignard reagent,  $\text{NH}_3$ , primary amine- Aldol condensation, Cannizzaro reaction, Perkin reaction, Knoevanagel reaction and Claisen- Schmidt reaction.

### Unit -III

Chemistry of Carbonyl Compounds – II Reaction mechanisms – Reformatsky reaction, benzoin condensation, Wittig reaction, haloform reaction – Reaction with  $\text{LiAlH}_4$  and  $\text{NaBH}_4$  – Clemmensen reduction, Wolff Kishner reduction, MPV reduction – reducing properties of Carbonyl compounds.

### Unit - IV

Malonic ester, acetoacetic ester and cyanoacetic ester-their preparation and synthetic applications Tautomerism of acetoacetic ester. Geometrical isomerism – Cis& Trans, E & Z notations – Geometrical isomerism in maleic acid and fumaric acid - physical and chemical properties of geometrical isomers.

### Unit-V

Bioinorganic chemistry- Importance of metals in biological system-Fe,Zn,Co. Structure and functions of Hemoglobin, Chlorophyll and cytochrome c- Electronic pathway of photosystem-I and II

Text Book reference

- 1.INORGANIC CHEMISTRY by J D LEE
2. Bioinorganic Chemistry by Asim K.Das

## CORE V – CHEMISTRY PAPER IV

Teaching hours: 45 hours per semester (3 hours per week)

**Subject description** This paper presents the basic aspects of thermodynamics, adsorption, chromatography and computer programming.

**Goals** To enable the students to understand the laws of thermodynamics, adsorption and the Computer C Programming.

**Objectives** To study the applications of computer programming in chemistry and the importance of entropy and thermodynamics, adsorption and chromatography.

#### UNIT I:

Introduction to second law of thermodynamics – Carnot cycle – entropy – Definition – Entropy changes in isothermal transformation – Trouton's rule. Entropy as function of T and V – Entropy as a function of T and P – Changes of entropy with T, Entropy changes in ideal gas – entropy of mixing of ideal gases.

#### UNIT II

General conditions of equilibrium and spontaneity- conditions of equilibrium and spontaneity under constants – definition of  $\Delta A$  and  $\Delta G$  – physical significance of  $-\Delta A$  and  $\Delta G$ . Temperature and pressure dependence of  $\Delta G$  – Gibbs – Helmholtz equation. Chemical equilibrium – The concept of chemical potential – chemical potential in a mixture of ideal gases – van't Hoff Isotherm and isochore – Third law of thermodynamics – statement and applications. Exception to third law.

### UNIT III

**ADSORPTION AND CATALYSIS** Adsorption – types, differences between chemisorption and physisorption – Adsorption of Gases by solids – Adsorption isotherms – Freundlich, Langmuir isotherms derivations – BET EQUATION (Derivation not required) – Adsorption from solutions – ion exchange adsorption Types and applications – Techniques to determine the adsorbed molecules on solid surfaces. Catalysis – classification – differences between Homogeneous and Heterogeneous catalysis – Acid Base catalysis – Kinetics and Mechanisms – Autocatalysis – Enzyme catalysis Characteristics and mechanism - Michaelis – Menton equation.

### UNIT IV

**CHROMATOGRAPHY** Chromatographic methods – Partition Adsorption – Basic principles – Differential migration, adsorption phenomenon, nature of adsorbents, choice of solvents and Rf value – Techniques and applications of Paper, Column and TLC – Gas chromatography and HPLC (Basic principles only).

### UNIT V :

C program for chemistry Structure of C program, Variables in C, C Keywords and constants in C. Operators in C – Arithmetic, Increment, Decrement, relational and logical operators.

Program: To calculate the pH of solutions– Calculation of pH of solution using Henderson equation- to compute the rate constant of a first order reaction – to compute the energy of activation of a reaction-Program to convert  $F^{\circ}$  degree  $C^{\circ}$ -PROGRAM TO CALCULATE MOLECULAR WEIGHT OF COMPOUNDS ( $C_6H_6$ ,  $C_2H_5OH$ ).

### REFERENCES:

- 1 .Principles of physical chemistry, B.P.Puri, L.R.Sharma and M.S.Phathania, ShobanlalNagin Chand & Co.
2. Physical chemistry G,W.Castelan, Narosa publishers.
3. Physical chemistry(volll) – N.B.Singh, ShivasaranDas,A.K.Singh –New Age International Publishers – First edition(2009)
4. Introduction to Chromatography – V.K.Srivatsava and K.K.Srivatsava – S.Chand& Company – Second edition(1981)
5. Computer for chemists – By PundirBansal – PragatiPrakasam Pubs

## CORE VI - CHEMISTRY PAPER V

Teaching hours : 60 Hours per semester (4 hours per week)

**Subject description** This paper presents the chemistry of few metals, phenols, amines and phase rule.

**Goals** To enable the students to learn about the reactions of phenol and amines .

**Objectives** To study the reaction of phenol and amines and applications of phase rule.

### Contents

#### UNIT I :

Occurrence, extraction, properties and uses of Zirconium, Vanadium, Molybdenum and Tungsten - their important compounds  $V_2O_5$ ,  $ZrOCl_2$ , ammonium molybdate, molybdenum blue,  $WO_2$ , and tungsten bronzes.

**UNIT II :** Monohydric phenols - preparation & properties –Reaction of monohydric phenols with mechanism – alkylation, esterification, nitration, sulphonation, halogenation coupling with diazonium salts – Kolbe, Reimer – Tiemann, Schotten – Bauman and Gattermann reactions.

**UNIT III :** Amines- Preparation and properties of aliphatic and aromatic primary, secondary and tertiary amines – their separation, comparison of their basicity – ring substitution, diazotization and coupling reaction of aromatic amines. Diazomethane and diazoacetic ester – preparation, structure and their synthetic applications.

**UNIT IV :** Phase rule and phase equilibria –the equilibrium condition. Stability of phase of a pure substance. Pressure dependence of  $\mu$  and T curves. The Clapeyron and Clapeyron-Clausius equations. Derivation of Gibbs phase rule. Phase equilibria in one component system.Reduced phase rule Phase diagram for water, carbondioxide system, phase diagram for two component system – construction of the phase diagram/Thermal analysis method Bi-Cd,Zn-Mg and Extraction of Agsystem.

**UNIT V :** Solutions: ideal and non ideal – Raoult's law, Henry's law – Nernst distribution law and its applications. Colligative properties- relative lowering of vapour pressure, elevation of boiling point, depression of freezing point and osmotic pressure- their applications.

## CORE VIII - CHEMISTRY PAPER VI

Teaching hour : 60 hours per semester (4 hours per week)

**Subject description** This paper presents the principle of radio activity, acids , bases and solvents.

**Goals** To enable the students to know about the radio activity, acid and bases, the role of solvent in chemical reactions.

**Objectives** To understand the principles of radio activity.

### Contents

#### UNIT I :

Structure of metals and alloys-substitutional and interstitial solid solution-Hume Rothery ratios-metallic bonding-electrical, optical and mechanical properties of metals-semiconductors, intrinsic and extrinsic-their uses.Super conductors-An elementary treatment.

#### UNIT II :

Artificial radio activity.Artificial transmutation of elements, synthesis of radio isotopes and. nuclear fission and fusion.Nuclear reactors – principle of working – production of electrical energy – atomic projects in India – Safety measures; disposal of reactor wastes – pollution.Nuclear reactions, mechanisms and different types of stellar energy.

#### UNIT III :

Nature of isotopes and isobars – detection and isolation of isotopes – various methods – importance of discovery of isotopes – uses of isotopes in various fields. Nuclear stability n/p ratio, magic numbers, C-12 atomic weight scale, C-14 dating, mass defect and nuclear binding energies. Radio activedisintergration series.

#### UNIT IV :COORDINATION CHEMISTRY -I

Types of ligands , IUPAC Nomenclature, Isomerism - Ionisation,hydrate, linkage, ligand and coordination isomerism. Stereoisomerism-geometrical and optical isomerism in 4 & 6 coordinated complexes.Theories of coordination compounds – Werner’s and Sidgwick’s EAN concept , Valence Bond theory – hybridisation, geometry and magnetic properties of  $[\text{Ni}(\text{CN})_4]^{2-}$ ,  $[\text{NiCl}_4]^{2-}$ ,  $[\text{Fe}(\text{CN})_6]^{4-}$ ,  $[\text{Co}(\text{NH}_3)_6]^{3+}$  and  $[\text{CoF}_6]^{3-}$ ,Crystal field theory – spectrochemical series , splitting of ‘d’ metal orbitals in octahedral and tetrahedral complexes, low spin & high spin complexes. Explanation of colour and magnetic properties using CFT,comparison of VBT and CFT.

#### UNIT V :

The solvents- solubility of compounds – effect of temperature on solubility- Role of water as solvent- chemical structure and solubility.Classifications of solvents-general behaviour- properties of ionizing solvents.Types of reactions in non aqueous solvents-protonic solvents - ammonia, hydrogen fluoride.Non Protonic solvents-SO<sub>2</sub> and BrF<sub>3</sub>. Organic solvents - C<sub>2</sub>H<sub>5</sub>OH and Ether.

### Text book

1.Malik,Wahid U., G.D. Tuli and R.D .Madan . Selected Topics in Inorganic Chemistry,7th ed., New Delhi S.Chand& Company Ltd., 2007.

## CORE IX - CHEMISTRY PAPER VII

Teaching hour : 60 hours per square (4 hours per week)

**Subject description** This paper presents the chemistry of carbohydrate, molecular rearrangements, amino acids and hetero cyclic compound.

**Goals** To enable the students to learn about carbohydrates, amino acids and hetero cyclic compounds.

**Objectives** To understand the importance of carbohydrate, amino acids in chemistry.

### Contents

#### UNIT I :

Optical activity of compounds with asymmetric carbon- racemisation – resolution – asymmetric synthesis- configuration D,L and R,S. nomenclature. Optical activity due to restricted rotation (biphenyls, allenes and spiranes) and molecular over crowding.

#### UNIT II :

Mechanism of molecular rearrangement reactions: PinacolPinacolone, Beckmann, Hoffmann, Curtius, Benzilic acid, Schmidt, Lossen, Cope and Claisen rearrangements.

**UNIT III** :Carbohydrates: Chemistry and structure of Glucose, Fructose, Sucrose and Maltose (cyclic structure as well). Starch and Cellulose - an elementary account. (Elucidation of structure not necessary) Inter conversion of sugars-mutarotation – Epimerisation.

**UNIT IV** :Aminoacids and proteins Amino acids-Classification –Preparation and properties of peptides and poly peptides-proteins classification based on physical properties and biological functions-primary, secondary and tertiary structure – properties and uses.

**UNIT V** :Heterocyclic compounds Chemistry of Furan, Pyrrole, Thiophene, Pyridine, Quinoline, Isoquinoline, Indolelsatin and Indigo.



## CORE X - CHEMISTRY PAPER VIII

Teaching hour : 60 hours per semester (4 hours per week)

**Subject description** This paper presents the principles of conduction Electro motive force, fuel cells.

**Goals** To enable the students to know about electro chemistry.

**Objectives** To study EMF, pH and their applications.

### Contents

#### UNIT I:

Electrical conduction, conduction in metals and in electrolytic solutions.Measurement of conductivity in electrolytic solutions.Migration of ions-Kohlrausch's law.Arrhenius theory of electrolytic dissociation-Ostwald's dilution law. Theory of strong electrolytes-Debye-Huckel-Onsagar theory (elementary account only ) verification. Debye-Falkenhagen effect-Wien effect-Transport numbers-**Definition and Determinations** .Conductometric titrations.

#### UNIT II:

Ionic Equilibria -Solubility and solubility product-determination of solubility product- Applications of solubility product principle. Dissociation of weak acids and bases-Dissociation constants-pH scale-common ion effect-buffer solutions- Determination of pH values of buffer mixtures-Henderson's equation-Hydrolysis of salts-Degree of hydrolysis.

#### UNIT III:

Electrode potentials-The standard hydrogen electrode kinds of electrodes and their potentials-Nernst equation.Single electrode potential-Determination and significance of electrode potentials-electro chemical series- temperature dependence of the cell EMF.Electrochemical cells-Secondary referenceelectrode-western-cadmium cell.EMF-computation and measurement of cell EMF.Thermodynamic quantities of cell reactions.

#### UNIT IV:

Reference electrodes-Electrodes for measurement of pH-concentration cells with and without transport-liquid junction potential-applications of EMF measurements.Redox potential-Redox indicators-uses.Potentiometric titrations.

#### UNIT V:

Fuel cells: Hydrogen- oxygen cell and hydrocarbon - oxygen cell. Storage cells. Lead storage cell and Nickel cadmium cell. Decomposition voltage-over voltage-Deposition and discharge potential.

**TEXTILE CHEMISTRY PAPER – IV**  
**TEXTILE CHEMISTRY – PRACTICAL**

**Lab- hours : 30 Hours per semester (2 hours per week)**

**LIST OF EXPERIMENTS**

1. Estimation of pH- paper, digital pH meter, pH solution
2. Volumetric analysis of Sodium Nitrite
3. Estimation of available chlorine in bleaching powder
4. Analysis of alkalinity of water by volumetry

**PREPARATION OF DYES**

1. Methyl Red
2. Malachite Green
3. Methyl Orange
4. Pare nitro benzene azo beta naphthol

**Dyeing of textile Materials**

1. Dyeing of cotton with direct dye
2. Dyeing of silk with acid dye
3. Variation of colour with temperature on direct dyeing
4. Screen printing on cotton fibre.