GENERAL CHEMISTRY– II

Semester	Subject Code	Category	Lecture hours		Theory hours		Practical hours		Credits
			Per week	Per sem.	Per week	Per sem.	Per week	Per sem.	
III	21CCH3A	Core-III	4	60	4	60	-	-	4

COURSE OBJECTIVES:

The students will be able to

- Gain knowledge about the principles of inorganic qualitative analyses and the p-Block elements such as Boron and Carbon family
- Understand the importance of Alkyl halides, Aromatic compounds, Alcohols, Phenols and Nitrogen containing compounds.
- Learn the Second law of thermodynamics, the concept of Entropy, concept of Gibbs free energy and their applications, Colloids and Thermochemistry.

COURSE OUTCOMES:

On the successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level (K1-K4)
CO1	Understand about the principles behind inorganic qualitative analyses and p- Block elements such as boron and carbon family.	K4
CO2	Know about alkyl halides, aliphatic nucleophilic substitution, elimination reactions and aromatic electrophilic substitution reactions.	K3
CO3	Learn about alcohols, phenols and nitrogen containing compounds.	K3
CO4	Acquire knowledge about second law of thermodynamics, the concept of entropy, concept of Gibbs free energy and their applications and third law of thermodynamics.	K2
CO5	Know about the applications of colloids and thermochemistry.	K4

*CO – Course Outcomes

Knowledge Level: K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze.

MAPPING WITH PROGRAMME OUTCOMES:

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	M	M	S	S
CO2	S	S	S	M	S	S
CO3	S	S	S	M	S	S
CO4	S	S	S	M	S	S
CO5	S	S	S	S	S	S

(S – Strong; M – Medium; L – Low)

UNIT – I: Principles of Inorganic Analysis, Boron and Carbon family 12 Hours

1.1 Principles of inorganic analysis – Reactions involved in the separation and identification of cations and anions in the qualitative inorganic analysis – Principles of equilibria – Common ion effect – Solubility product and their applications in qualitative analysis – General characteristics of elements of Group III A with reference to occurrence, electronic configuration, atomic and ionic radii, ionization energy, electron affinity, electronegativity, oxidation states, inert pair effect, halides, oxides, hydrides – Lewis acid base concept of boron – Anomalous behaviour of Boron – Diagonal relationship between Boron and Silicon – Preparation, properties and structure of Diborane and Borazole.

1.2 General characteristics of elements of Group IV A with reference to occurrence, electronic configuration, catenation, metallic and non-metallic character, atomic and ionic radii, ionization energy, electron affinity, electronegativity, oxidation states, inert pair effect, halides, hydrides – Allotropic forms of carbon – Crystalline and amorphous forms – Structure of graphite, diamond and fullerenes.

UNIT – II: Alkyl halides and Aromatic Electrophilic Substitution 12 Hours

2.1 Classification of alkyl halides – Methods of formation of haloalkanes from alcohols, from alkenes and Hunsdiecker reaction – Nucleophilic substitution reactions – mechanisms and stereochemistry of nucleophilic substitution reactions – S_N1, S_N2 and S_Ni reactions with energy profile diagrams – Elimination reactions: Bimolecular elimination reaction (E2) –Unimolecular elimination reaction (E1) – Mechanisms of E1 and E2 – Reactions – Dehydrohalogenation – Hofmann and Saytzeff's rules.

2.2 Aromaticity – Definition – Huckel's rule – Aromatic electrophilic substitution – Mechanism of nitration, halogenation, sulphonation and Friedel-Crafts reaction – Activating and deactivating substituents – Orientation in monosubstituted benzenes.

UNIT – III: Alcohols, Phenols and Nitrogen Containing Compounds 12 Hours

3.1 Preparation of alcohols through hydration, oxymercuration and Grignard reaction – Differences between primary, secondary and tertiary alcohols – General Reactions of alcohols – Oxidation, dehydration, conversion to alkyl halides – Preparation of phenol from benzene – Comparison of acidity of phenol with alcohols – Relative acid strength of

substituted phenols – Reactions of phenols – Esterification, Oxidation, Kolbe's reaction, Reimer-Tiemann and Gattermann reaction.

3.2 Nitroalkanes – Preparation of nitroalkanes from alkyl halide and haloacids – General chemical characteristics – Amines – Preparation: Gabriel phthalimide reaction and Hofmann reaction – Differences between primary, secondary and tertiary amines – Reactions: Mannich, Libermann's nitroso reaction and carbylamine reaction.

UNIT – IV: Thermodynamics 12 Hours

4.1 Second law of thermodynamics – Need for second law of thermodynamics – Statements of Second law of thermodynamics – Carnot cycle – Carnot theorem – Efficiency of heat engine – Concept of entropy – Entropy change in a cyclic process – Entropy change in isothermal expansion of ideal gas – Entropy change in reversible and irreversible process – Entropy change accompanying by change of phase – Calculation of entropy change of an ideal gas with changes in pressure, volume and temperature – Entropy of mixing of ideal gases – Physical significance of entropy.

4.2 Gibbs free energy – Work function – Variation of free energy change with temperature and pressure – Maxwell's relationship – Criteria for spontaneity – Gibbs-Helmholtz equation – Partial molar properties – Clapeyron-Clausius equation and its applications – Third law of thermodynamics – Nernst heat theorem – Statement of third law of thermodynamics – Evaluation of absolute entropy from heat capacity measurements – Exceptions to III law of thermodynamics.

UNIT – V: Colloids and Thermochemistry 12 Hours

5.1 Colloids – Dispersion medium and dispersed phase – Classification of Colloids – Characteristics of True solutions, Colloidal solutions and Suspensions – Optical properties – Tyndall effect – Kinetic properties – Brownian motion – Electrical properties – Electrophoresis and Electro-osmosis – Theory of electrical double layers – Zeta potential – Applications of colloids.

5.2 Thermochemistry – Heat of formation, Heat of combustion, Heat of solution, Heat of neutralization, Heat of fusion, Heat of vaporisation, Heat of sublimation, Heat of transition – Hess's law of transition – Determination of Heat of transition using Hess's law of constant heat summation – Problems.

TEXT BOOKS:

S. No.	Authors	Title	Publishers	Year of publication
1.	P. L. Soni and H. M. Chawla	Text Book of Organic Chemistry	Sultan Chand and Sons	1986
2.	K. S. Tewari, N. K. Vishnoi and S. N. Mehrotra	A Textbook of Organic Chemistry	Vikas Publishing House, 3rd edition	2011
3.	B. R. Puri, L. R. Sharma and Madan S. Pathania	Principles of Physical Chemistry	Vishal Publication Co.	2013

REFERENCE BOOKS:

S. No.	Authors	Title	Publishers	Year of publication
1.	B. R. Puri, L. R. Sharma and K. C. Kallia	Principles of Inorganic Chemistry	Milestone Publications	2013
2.	W. U. Malik, G. D. Tuli and R. D. Madan	Selected Topics in Inorganic Chemistry	S. Chand Publications	2008
3.	Arun Bahl and B.S. Bahl	Advanced Organic Chemistry	S. Chand and company Ltd.	2010
4.	M. K. Jain and S. C. Sharma	Modern Organic Chemistry	Vishal Publishing Co.	2017
5.	R. T. Morrison and R. N. Boyd	Organic Chemistry	Prentice- Hall of India	2008
6.	P. L. Soni	Text Book of Physical Chemistry	Sultan Chand and Sons	1992
7.	R. D. Madan	Modern Inorganic Chemistry	S. Chand Publications, Reprint	2014
8.	J. E. Huheey	Inorganic Chemistry – Principles, Structure and Reactivity	Harper Collins, New York, IV Edition	1993
9.	Arun Bahl, B. S. Bahl and G. D. Tuli	Essentials of Physical Chemistry	S. Chand and Company Pvt. Ltd.	2012

TEACHING METHODOLOGY:

- Power Point Presentations
- Assignments
- Animated videos
- Chalk and Board