Tentative Subject Code Template

1st and 2nd Semester- 1st Year UG

SEMESTER	COURSE CODE	NAME OF THE COURSE
I	CH 1100	CHEMISTRY FOR BIOLOGISTS-I
I	CH 1101	CHEMISTRY PRACTICAL FOR BIOLOGISTS-I
I	CH 1505	ANALYTICAL CHEMISTRY
I	CH 1506	BASIC CONCEPTS IN INORGANIC CHEMISTRY
I	CH 1507	VOLUMETRIC ANALYSIS AND INORGANIC PREPARATIONS
II	CH 2104	GENERAL CHEMISTRY FOR MATHS AND PHYSICS STUDENTS
II	CH 2105	GEN.CHEM.LAB FOR MATHS AND PHYSICS STUDENTS
II	CH 2506	CHEMISTRY OF HYDROCARBONS
II	CH 2507	THERMODYNAMICS
II	CH 2508	ORGANIC QUALITATIVE ANALYSIS

CH 1100 : CHEMISTRY FOR BIOLOGISTS-I

(Offered to B.Sc. Zoology and Plant Biology)

Semester – I | No. of Credits: 3

Course: Allied Required (AR-1) | No. of hrs : 50 (4hrs/wk)

Objective:

To enable the students to understand the concepts chemistry.

1.1 **Unit 1: Handling of chemicals and Data analysis** (13 hrs)

Storage and handling of chemicals: Handling of acids, ethers, toxic and poisonous chemicals. Antidotes, threshold vapour concentration and first aid procedure.

1.2 *Errors in chemical analysis*

Accuracy, precision. Types of error-absolute and relative errors. Methods of eliminating and minimizing errors.

1.2 *Separation techniques*–Solvent extraction. Principle of adsorption and partition chromatography, column chromatography, thin layer chromatography (TLC), paper chromatography and their applications.

Unit 2: Chemical bonding (13 hrs)

2.1 *Ionic Bond*: Nature of Ionic bond. Structure of NaCl, KCl and CsCl. Factors influencing the formation of ionic bond.

2.2 *Covalent Bond*: Nature of covalent bond. Structure of CH_4, NH_3, H_2O based on hybridisation.

2.3 *Coordinate Bond*: Nature of coordinate bond. Coordination complexes. Werner's theory. Geometrical and optical isomerism in square planar and octahedral complexes. Mention of structure and functions of chlorophyll and hemoglobin

2.4 *Hydrogen Bond*: Theory and importance of hydrogen bonding. Types of hydrogen bonding. Hydrogen bonding in carboxylic acids, alcohol, amides, polyamides, DNA and RNA.

2.5 *van der Waal's forces*: Dipole – dipole and dipole - induced dipole interactions.

Unit 3: Volumetric analysis (10 hrs)

3.1 *Methods of expressing concentration*: normality, molarity, molality, ppm.

3.2 *Primary and secondary standards*: preparation of standard solutions

3.3 *Principle of volumetric analysis*: end point and equivalence points.

3.4 *Strong and weak acids and bases* - Ionic product of water , pH, pK_a, pK_b. Buffer solutions - pH of buffer solutions. Mention of Henderson equation & its significance.

Unit 4: Kinetics (6 hrs)

4.1 Rate, rate law, order and molecularity. Derivation of rate expressions for I and II order reactions.

4.2 *Catalysis*-Homogeneous and heterogeneous catalysis. Enzyme catalysis, enzymes in biological system and in industry.

Unit 5: Chemistry of biomolecules (8 hrs)

5.1 *Fats* – Occurrence and composition. Hydrolysis of fats.

5.2 *Vitamins* – Source, provitamin, properties and classification. Structure and function of vitamin A, C, D, K and E

5.3 *Hormones* – Thyroxin, adrenaline and sex hormones (structure and functions only)

Text Books :

1. R. Gopalan, S. Sundaram, *Allied Chemistry*, Sultan Chand and Sons, **1995**.

2. U. Sathyanarayana, *Biochemistry*, Books and allied (p) Ltd, **1999**.

3. B.R.Puri and L.R.Sharma, *Principles of physical chemistry*, Shoban Lal Nagin Chand and Co. 33rd edition, **1992**.

Reference Books:

1. D.A. Skoog, D.M. West and F.J. Holler, *Analytical Chemistry: An Introduction*, 5th edition, Saunders college publishing, Philadelphia, **1990**.

2. G.C. Hill, J.S. Holman, *Chemistry in Context*, ELBS, **1998**

3. W.R. Kneen, M.J.W. Rogers, P. Simpson, *Chemistry – Facts, patterns and principles*, ELBS, **1999**.

CH 1101 : CHEMISTRY PRACTICAL FOR BIOLOGISTS-I

(Offered to B.Sc. Zoology and Plant Biology)

Semester – I | No. of Credit :1

Course : Allied Required(**AR-1**) | No. of hrs : 25 (2hrs/wk)

Objective:

To enable the students to understand the concept of organic analysis.

Organic Analysis:

a)Detection of N, S and halogens

b) Test for aliphatic and aromatic nature.

c)Test for saturation and unsaturation.

d)Nature and identification of the following functional groups

i) Carboxylic acid
ii) Phenols
iii) Aldehydes
iv) Ketones
v) Carbohydrates
vi) Primary amines
vii) Amides

Text Books:

1. N.S. Gnanapragasam and G. Ramamurthy, *Organic chemistry* – Lab manual, S. Viswanathan Co. Pvt. Ltd., 1998.

2. J.N. Gurtu and R. Kapoor, *Advanced Experimental Chemistry(Organic),* S. Chand and Co., 1987.

CH 1505 : ANALYTICAL CHEMISTRY	
Semester – I	No. of Credits : 3
Course: Major Core (MC)	No. of hrs : 40 (3 hrs/wk)

Objectives

1. *To enable the student to develop the habit of handling analytical data.*
2. *To learn the principles of basic analytical methods and their applications.*

Unit-1: Handling of Chemicals and Data analysis (6 hrs)

1.1 *Safety and hygiene in the Chemistry Lab*:

Storage and handling of chemicals, Handling of acids, ethers, toxic and poisonous chemicals. Antidotes, threshold vapour concentration and first aid procedure. MSDS, COSHH.

1.2 *Error in chemical analysis*

Accuracy and precision, Absolute and relative errors. Methods of eliminating or minimizing errors. Precision: mean, median, average deviation and coefficient of variation. Significant figure and its relevance. Normal error curve and its importance.

Unit-2: Separation and Purification Techniques (10 hrs)

2.1 *Chromatographic techniques and applications*

Principles of adsorption and partition chromatography: Column and Paper chromotography. TLC, ion-exchange chromatography - technique and applications. Gas chromatography, principle, detector and applications.

2.2 *General purification techniques*

Purification of solid organic compounds: recrystallisation, sublimation. Use of miscible solvents. Use of drying agents and their properties. Purification of liquids. Techniques of distillation. Chemical methods of purification and test of purity.

Unit-3: Titrimetric Methods of Analysis (10 hrs)

3.1 *General Principle*

Methods of expressing concentration of solutions. Types of titrations. Requirements for titrimetric analysis.Primary and secondary standards. Limitation of volumetric analysis.

3.2 *Acid-base Equilibria*

pH of strong and weak acid solutions. Buffer solutions. Henderson equations. Preparation of acidic and basic buffers. Relative strength of acids and bases from K_a and K_b values. Neutralisation-titration curve, theory and choice of indicators.

3.3 *Complexometric titrations*

Stability of complexes. Titration involving EDTA. Metal ion indicators and their characteristics.

Unit-4: Solubility Equillibria (10 hrs)

4.1 *Precipitation titrations*

Concept of sparingly soluble salts. Relation between solubility and solubility products. Argentometric titrations, indicators for precipitation titrations involving silver nitrate. Determination of chloride by Volhard's method. Adsorption indicators.

4.2 *Gravimetric methods of analysis:*

Separation by precipitation. Factors affecting solubility, gravimetric factor. Purity of precipitates, von Weiman ratio. Co-precipitation and post precipitation. Precipitation from homogeneous solution.

Unit-5: Thermal Analysis (4 hrs)

Principle of thermogravimetric analysis (TGA). Differential thermal analysis (DTA): nstrumentation and applications. Factors affecting TGA and DTA curves. TGA of $AgNO_3$, $CaC_2O_4.H_2O$ and DTA of sulphur.

Text Books

1. R.A. Day and A.L. Underwood, *Quantitative Analysis*, 5th edition, Prentice Hall of India Private Ltd., New Delhi, **1988**.
2. U. N. Dash, *Analytical Chemistry: Theory and Practice*, Sultan Chand and sons Educational Publishers, New Delhi, **2011**.
3. B. R. Puri and L.R. Sharma, *Principles of Physical Chemistry*, Shoban Lal Nagin Chand and Co. 33rd edition, **1992**.
4. R. Gopalan, P. S. Subramanian, K. Rengarajan, *Elements of Analytical Chemistry*, Sultan Chand, New Delhi, **2007**.
5. S. Usharani, *Analytical Chemistry*, McMillan Publisher, **2000**.

References

1. D. A. Skoog, D. M. West and F. J. Holler, *Analytical Chemistry: An Introduction*, 5th edition, Saunders college publishing, Philadelphia, **1998**.

2. H. Kaur *Instrumental Methods of Chemical Analysis* Pragati Prakashan, Meerut, **2010**.

3. V.K. Srivastava, K.K. Srivastava, *Introduction to Chromatography: Theory and Practice*, S. Chand and Company, New Delhi, **1987**.

4. A.K. Srivastava, P.C. Jain, *Chemical Analysis: An Instrumental Approach* for B.Sc. Hons. and M.Sc. Classes, S. Chand and Company Ltd., Ram Nagar, New Delhi, **2010**.

CH 1506: **BASIC CONCEPTS IN INORGANIC CHEMISTRY**

Semester-I No. of Credits : 3

Course: Major Core (**MC**) No. of hrs : 40 (3hrs/wk)

Objectives

1. *To know the arrangement of elements in the periodic table and the periodic properties.*
2. *To understand the different kinds of chemical forces in molecules.*
3. *To identify the nature of chemical bond in a given inorganic compound.*

Unit 1: Atomic Structure and Periodic Table (8 hrs)

1.1 *Electronic configuration*: Bohr theory, duel nature of electrons, Heisenberg uncertainty principle, Pauli's exclusion principle, Hund's rule, sequence of energy levels (Aufbau principle).

1.2 *Periodicity*: Periodic law and arrangement of elements in the periodic table, IUPAC nomenclature and group number. Horizontal, vertical and diagonal relationships in the periodic table.

1.3 *Properties of atoms*: Size of atoms and ions-atomic radii, ionic radii, covalent radii; trend in ionic radii, ionization potential, electron affinity; electronegativity-Pauling, Mulliken-Jaffe, Allred-Rochow definitions; oxidation states and variable valency; isoelectronic relationship; inert-pair effect. Atomic, molecular and equivalent weights; Avagadro's principle and mass-volume relationship.

Unit 2: Ionic bond (8 hrs)

2.1 Properties of ionic compounds, factors favoring the formation of ionic compounds-ionization potential, electron affinity, and electronegativity.

2.2 *Lattice energy(U_o)* : Born-Lande equation (derivation not required). Factors affecting lattice energy. Born-Haber cycle-enthalpy of formation (ΔH_f) of ionic compounds.Stability and solubility of ionic compounds of alkali- and alkaline earth metals on the basis of ΔH_f and U_o. Enthalpy of salvation and enthalpy of solution.

2.3 Covalent character of ionic compounds-Fajan's rules; effects of polarization-solubility, melting points, and thermal stability of typical ionic compounds.

Unit 3: Covalent Bond (11 hrs)

3.1 Lewis theory-Octet rule and its exception, electron dot structural formula; Sidgwick-Powell theory-prediction of molecular shapes; Valance Bond theory-arrangement of electrons in molecules. Hybridization and geometry of molecules.

3.2 VSEPR model-Effect of bonding and nonbonding electrons on the structure of molecules, effect of electronegativity. Illustration of structures by VESPR model-NH_3, SF_4, ICl_4^-, ICl_2^-, XeF_4, XeF_6.

3.3 MO theory: LCAO method-criteria of orbital overlap, types of molecular orbitals-σ, π- and δ-MOs; combination of atomic orbitals to give σ- and π-MOs and their schematic illustration; qualitative MO energy level diagram of homodiatomic molecules-H_2 to Ne_2 and their magnetic properties, bond order and stability of molecules.

Unit 4: Metallic and Weak Bonds (5 hrs)

4.1 *Metallic bond*: Metallic properties, band theory of metals; semiconductors: *n*- and *p*-type semiconductors.

4.2 *Weak bonds*: Hydrogen bonding-intra- and intermolecular hydrogen bonding, influence on the physical properties of molecules, comparison of hydrogen bond strength and properties of hydrogen bonded N, O, and F compounds; crystalline hydrates and clathrates; van der waals forces, ion dipole-dipole interactions.

Self study:Properties of molecules exhibiting inter- and intramolecular hydrogen bonding.

Compounds formed by London dispersive forces and van der Waals forces.

Unit 5: Acids and Bases (8 hrs)

5.1 *Types of chemical reactions*: Acid-base, oxidation-reduction, electron transfer and double decomposition reactions. Balancing chemical reactions by oxidation number and ion-electron method.

5.2 *Theories of acids and bases*: Arrhenius theory of acids and bases in protic solvents. Bronsted-Lowry theory, Lewis theory, the solvent system. Lux-Flood definition and Usanovich definition.

5.3 *Nonaqueous solvents*: Classification-protonic and aprotic solvents. Liquid ammonia as solvent-solutions of alkali and alkaline earth metals in ammonia.

Self study: Common protic and aprotic nonaqueous solvents.Identification of acids and bases according to different definitions.

Text Books

1. J. D. Lee, *Concise Inorganic Chemistry*, 5th ed., Blackwell Science, London, **1996**.
2. F. A. Cotton, G. Wilkinson and P. L. Guas, *Basic Inorganic Chemistry*, 3rd ed., John Wiley, **1994**.
3. B. Douglas, D. McDaniel and J. Alexander, *Concepts and Models of Inorganic Chemistry*, 3rd ed., John Wiley, **1994**.
4. B. R. Puri, L. R. Sharma, K. C. Kalia, *Principles of Inorganic Chemistry*, Shoban Lal Nagin Chand and Co., **1996**.

References

1. J. E. Huheey, E. A. Kieter and R. L. Keiter, *Inorganic Chemistry*, 4th ed., Harper Collins, New York, **1993**.
2. D. F. Shriver and P. W. Atkins, *Inorganic Chemistry*, 3rd ed., W. H. Freeman and Co, London, **1999**.
3. T. Moeller, *Inorganic Chemistry: A Modern Introduction*, Wiley, New York, **1990**.

CH 1507 : VOLUMETRIC ANALYSIS AND INORGANIC PREPARATIONS	
Semester – I	No. of Credits : 3
Course: Major Core (MC)	No. of hrs : 40 (3hrs/wk)

Objective

To enable the students to acquire the quantitative skills in volumetric analysis.

A. Volumetric Practicals

1. Calibration of volumetric apparatus: Burette, pipette and standard flasks.
2. Acid – base titrations:
   a. Estimation of HCl.

   b. Estimation of oxalic acid.

3. Redox titrations:
   a. Estimation of Ferrous ammonium sulphates (Permanganometry).

   b. Estimation of calcium (Permanganometry).

   c. Estimation of $KMnO_4$ (Iodometry).

   d. Estimation of copper (Iodometry).

   e. Estimation of Fe^{2+}-Fe^{3+} mixture using diphenyl amine (Dichrometry)

3. Complexometric titrations:
   a. Estimation of calcium.

   b. Estimation of magnesium.

B. Inorganic preparations

Preparation of Ferrous ammonium sulphate.

Preparation of tetraamminecopper(II) sulphate.

Preparation of potassium trioxalatoaluminate.

Preparation of potassium trioxalatochromate

Text books

1. Sundaram, Krishnan, Raghavan, *Practical Chemistry* (Part II), S. Viswanathan Co. Pvt., 1996.

2. N.S. Ganapragasam and G. Ramamurthy, *Organic Chemistry – Lab manual*, S. Viswanathan Co. Pvt., 1998.

Reference

1. B.S. Furniss, A.J. Hannaford, P.W. G. Smith, A.R. Tatchell, *Vogel's Text Book of Practical Organic Chemistry*. 5th Edn., Pearson Education, 2005.

CH 2104: GENERAL CHEMISTRY FOR MATHS AND PHYSICS STUDENTS

(Offered to B.Sc. Physics and Mathematics)

Semester – II	No. of Credits : 3
Course: Allied Required (AR-2)	No. of hours : 50 (4hrs/wk)

Objectives:

1. *To get a good exposure to the basic concepts of chemistry*
2. *To enable them to apply concepts related to chemistry in their careers.*

Unit 1: Coordination compounds (8hrs)

1.1 Double salts and coordination compounds. Basic concepts of coordination compounds.

1.2 Types of ligands. IUPAC nomenclature of mononuclear complexes.

1.3 Theories: Werner's, Sidgwick's and Pauling's theories. Explanation of shapes and magnetic nature.

1.4 Mention of biologically important coordination compounds: Haemoglobin and Chlorophyll.

Unit 2: Basic concepts in organic chemistry. (12hrs)

2.1 Electronic displacement effects: Inductive, resonance and steric effects.

2.2 *Organic reactions and their basic mechanisms*: Addition – ionic, free radical, electrophilic, nucleophilic. Substitution – S_N1 and S_N2 reaction of alkyl halides. Elimination - E1 and E2 reactions. Rearrangement – inter and intramolecular.

2.3 *Isomerism*:

Geometrical isomerism: methods of differentiating cis and trans isomers on the basis of boiling point, melting point, dipole moment and chemical reaction. Optical isomerism with special reference to lactic and tartaric acids. Conformational isomerism of ethane, n-butane.

Unit 3: Electrochemistry and kinetics **(**12hrs)

3.1 *Electrochemistry*:

Strong and weak electrolytes.Ionic product of water, pH, pK_a, pK_b, buffer solutions,

solubility, solubility product of sparingly soluble salts, electrode potential, standard hydrogen electrode and calomel electrode, cell potential -standard western

cell,electrochemical cell – galvanic and electrolytic cell. Derivation of Nernst equation, calculation of EMF of the cell. Corrosion – causes and prevention.

3.2 *Kinetics and catalysis*:

Order and molecularity.Derivation of rate expression for first and second order reaction. Methods of determining order of a reaction.Catalysis - homogeneous and heterogeneous. Energy of activation and Arrhenius equation.

Unit 4: Photochemistry (8hrs)

Comparison between thermal and photochemical reactions, Grotthus-Drapper'slaw, Einstein's law, quantum yield, photosensitization, Beer-Lambert's law.

Unit 5: Industrial chemistry (10hrs)

5.1 *Water treatment*

Sources of water.Hardness of water, disadvantages of hard water. Estimation of hardness by EDTA method.Purification process – ion exchange, reverse osmosis, activated charcoal treatment. Disinfection – ozone, UV, chlorination, specification of drinking water.

5.2 *Pollution and its control*

Air pollution, effect of air pollution- acid rain and greenhouse effect, ozonedepletion.Water pollution – significance of BOD and COD values.

Text Books:

1. R. Gopalan, S. Sundaram, *Allied Chemistry*, Sultan Chand and Sons **1995**.

2. P. C. Jain and M. Jain, *Engineering Chemistry*, 10th ed.; Dhanpatrai and sons: Delhi, **1993**

3. C.N.R. Rao, *University General Chemistry*, Macmillan Co., India Ltd, **1973**.

4. M.J. Sienko and R.A. Plane, *Chemistry-Principles and Properties*, international Student edition. **1995**.

References:

1. G.C. Hill, J.S. Holman, *Chemistry in Context*, ELBS, **1998**.

2. W.R. Kneen, M.J.W. Rogers, P. Simpson, *Chemistry – Facts, patterns and principles*, ELBS, **1999**.

3. Bruce H. Mahan, *University Chemistry*, 3rd edition, Addition-Wesley Publishing Company, **1977**

CH 2105 : GEN.CHEM.LAB FOR MATHS AND PHYSICS STUDENTS

(Offered to B.Sc. Physics and Mathematics)

Semester – II | No. of Credit : 1

Course: Allied Required (**AR-2**) | No. of hrs : 25 (2hrs/wk)

Objectives:

1. *To enable the students to understand the concepts of organic analysis*
2. *To apply such analysis in their scientific area of interests.*

Organic Analysis:

a) Detection of N, S and halogens

b) Test for aliphatic and aromatic nature of substances.

c) Test for saturation and unsaturation.

d) Nature and identification of the following functional groups

- i) Carboxylic acid
- ii) Phenols
- iii) Aldehydes
- iv) Ketones
- v) Carbohydrates
- vi) Primary amines
- vii) Amides

Text Books:

1. N.S. Gnanapragasam and G. Ramamurthy, *Organic chemistry – Lab manual*, S. Viswanathan Co. Pvt. Ltd., **1998**.
2. J.N. Gurtu and R. Kapoor, *Advanced Experimental Chemistry (Organic),* S. Chand and Co., **1987**.

CH 2506: CHEMISTRY OF HYDROCARBONS	
Semester – II	No. of credits: 3
Course: Major Core (MC)	No. of hrs : 40 (3hrs/wk)

Objectives

1. *To understand the basic properties of organic compounds*
2. *To know the method of naming organic compounds*
3. *To learn various methods of preparation of hydrocarbons*
4. *To understand the mechanism of reactions of hydrocarbons.*

Unit 1: Nomenclature, Classification and Basic Properties (8 hrs)

1.1 Trivial and IUPAC nomenclature. Classification, Geometry of hydrcarbons. Hybridization.

1.2 *Cleavage of bonds*: Homolytic and heterolytic cleavages, bond energy, bond length and bond angle.

1.3 *Aromaticity and resonance*: Huckel's rule, Antiaromaticity, Mobius model.

1.4 *Electron displacement effects*: Inductive, inductomeric, electromeric, mesomeric, resonance, hyperconjugation and steric effects.

1.5 *Tautomerism:* Keto-enoltautomerism-Identification, acid and base catalysed inter conversion mechanism.Amido-imidol and nitro acinitro forms.

1.6 Stability of reaction intermediates, carbocation, carbanion, and free radicals.

Self Study: Comparison of stability of reaction intermediates

Unit 2: Alkanes and Cycloalkanes (10 hrs)

2.1 *Alkanes*: Preparation by Wurtz reaction, reduction or hydrogenation of alkenes, Corey-House method, petroleum refining

Reactions: Mechanism of halogenation, free radical substitution, sulphonation, nitration, oxidation, cracking and aromatisation.

2.2 *Cycloalkanes*: Preparation using Wurtz reaction, Dieckmann's ring closure and reduction of aromatic hydrocarbons.

Reactions: Mechanism of substitution and ring-opening reactions. Baeyer's strain theory and theory of strain less rings.

Self Study: Properties of alkanes and cycloalkanes, comparison of stability of ring compounds

Unit 3: Alkenes (8 hrs)

3.1 *Alkenes*: General methods of preparation by dehydrogenation, dehydrohalogenation, dehydration, Hoffmann and Saytzeff rules, cis and trans eliminations.

Reactions: Mechanism of electrophilic and free radical addition, addition of hydrogen, halogen, hydrogen halide (Markownikoff's rule), hydrogen bromide (peroxide effect),

sulphuric acid, water, hydroboration, ozonolysis, dihydroxylation with $KMnO_4$, allylic bromination by NBS.

3.2 Stability of alkenes and dienes (conjugated, isolated and cumulative dienes).

3.3 General methods of preparation, mechanism of dehydrohalogenation of dienes.
Reactions: Mechanism of 1,2- and 1,4-additions, Diels-Alder reactions. Polymerization: addition polymerization, Ziegler Natta catalysed polymerization.

Unit 4: Alkynes (6 hrs)

4.1 *Preparation*: Mechanism of dehydrohalogenation and dehydrogenation.

4.2 *Reactions*: Acidity of alkynes, formation of acetylides, Mechanism of addition of water, hydrogen halides and halogens, oxidation, ozonolysis and hydroboration/oxidation.

Self study: Preparation and properties of higher order alkenes, dienes and alkynes. Examples of polymerization reactions

Unit 5: Homocyclic Aromatic Hydrocarbons (8 hrs)

5.1 *Benzene*: Extraction, industrial and laboratory preparations, purification.

Properties: Electrophilic substitution reactions, Nitration, sulphonation, halogenation, Friedel Crafts alkylation and acylation with mechanisms.

5.2 Di substitution reactions of aromatic compounds, orientation and reactivity.

5.3 *Polynuclear aromatic hydrocarbons*: Preparation and properties of naphthalene, anthracene and phenanthrene. Synthetic applications.

Self study: Preparation of disubstituted benzenes. Extraction of poly nuclear aromatic hydrocarbons

Text books

1. R. T. Morrison and R. N. Boyd, *Organic Chemistry*, 6th Edition, Printice-Hall of India Limited, New Delhi, **1992**.

2. B. Y. Paula, *Organic Chemistry*, 3rd Edition, Pearson Education, Inc.(Singapore), New Delhi, reprint, **2002**.

3. T. W. Graham Solomons, *Organic Chemistry*, 6th edition, John Wiley and sons, **1996**.

References

1. J. March, *Advanced Organic Chemistry*, 4th Edition, John Wiley and Sons, New York, **1992**.

2. S. H. Pine, *Organic Chemistry*, 5th Edition, McGraw Hill International Edition, Chemistry Series, New York, **1987**.

3. S. N. Ege, *Organic Chemistry, Structure and Reactivity*, 3rd Edition, A.I.T.B.S., New Delhi, **1998**.

4. H. Cram and Hammond, *Organic Chemistry* (3rd Edition), McGraw-Hill, Kogakusha, Limited, **1970**.

5. F. A. Carey, *Organic Chemistry*, 3rd edition, Tata-McGraw Hill Publications, New Delhi, **1999**.

6. I. L. Finar, *Organic Chemistry, Vol-1,* 6th edition, Pearson Education Asia. **2004**

CH 2507: THERMODYNAMICS	
Semester – II	No. of Credits: 3
Course: Major Core (MC)	No. of hrs : 40 (hrs/wk)

Objective:

To understand the concepts of thermodynamics and apply it to physical and chemical systems.

Unit-1: First law of thermodynamics and its applications (10 hrs)

1.1 *First law of thermodynamics*: Statement and the concept of internal energy & enthalpy- Exact & inexact differentials, state & path functions. Concept of ideal gas: Gas laws, Kinetic theory of gases – postulates and derivation of the equation $PV = 1/3\ mnc^2$. Deviation from ideal behavior, van der Waals equation of state – Derivation, Virial equation of state

1.2 *Applications first law of thermodynamics to ideal gases*: Heat capacity, relation between C_P and C_V. Isothermal process: Change in internal energy, work done, $W_{(rev)}$ and $W_{(irrev)}$. Adiabatic process: work done, and entropy changes.

1.3 *Application of the laws of thermodynamics to real (van der Waals) gases*: Isothermal process- Work done, change in internal energy, heat absorbed. Adiabatic process: Work done - Joule - Thomson effect- Joule- Thomson coefficient and its significance, inversion temperatures. Variation of enthalpy change of reaction with temperature (Kirchoff's equation).

Self-study: Derivation of critical constants in terms of van der waals constants

Unit-2: Thermochemistry (8 hrs)

2.1 Measurements of thermal changes. Heats of reaction. Calculation of change in internal energyfrom the enthalpy change, standard states and standard heats of formation;

2.2 Integral heat of solution and dilution, heat of neutralization, heat of hydration; heat of transition.

2.3 Bond energy, heat of combustion and heat of reaction.

Self-study:*Determination of calorific value using Bomb calorimeter*

Unit-3: Second Law of Thermodynamics (8 hrs)

3.1 Limitations of first law and the need for the second law. Formulation of second law of thermodynamics on the basis of Carnot cycle. Thermodynamic principle of working of refrigerator.

3.2 Criteria of spontaneity. Changes in S, G and A as criteria for spontaneous process, dS, dG and dA.

Evaluation of ΔG and ΔS for the mixing, Maxwell's equations and thermodynamic equation of state. Gibbs-Helmholtz equation.

Self-study: Trouton's rule and its significance.

Unit -4: Thermodynamics of reversible processes (9 hrs)

4.1 *Law of mass action*: Various forms of equilibrium constants. Relationships between K_P and K_C; significance of equilibrium constants. Vant Hoff isotherm. Derivation of thermodynamicequilibrium constant, and its relationship with change in standard free energy. vant Hoff isochore.

4.2 Le-Chatelier-Braun principle: Formation of ammonia. Application of law of mass action and Le-Chatelier-Braun principle to homogeneous gaseous reactions: dissociation of nitrogen tetroxide and ammonia.

Self-study: Formation of HI, dissociation of PCl_5.

Unit- 5: Third law of thermodynamics (5 hrs)

Nernst heat theorem- Planck and Lewis Randall formulation of third law. Absolute entropy of solids, liquids and gases. Evaluation of the standard entropy of oxygen, on the basis of heat capacity. Exceptions to third law of thermodynamics.

Text Books

1. S.H. Maron and J.B. Lando, *Fundamentals of Physical Chemistry*, Macmillan limited, New York, **1966**.
2. B.R. Puri and L.R. Sharma, *Principles of Physical Chemistry*, Shoban Lal Nagin Chand and Co. 33rd edition, **1992**.
3. P.W. Atkins, *Physical Chemistry*, 7th edition, Oxford university press, **2001**.
4. S.K. Dogra and S. Dogra, *Physical Chemistry Through Problems*, New age international, 4th ed, **1996**.

References

1. G. W. Castellan, *Physical Chemistry*, Narosa publishing house, third edition **1985**.
2. I. M. Klotz and R. M. Rosenberg, *Chemical Thermodynamics*, John Wiley and sons, Inc. **1994**.
3. J. Rajaram and J.C. Kuriacose, *Thermodynamics*, Shoban Lal Nagin Chand and Co. **1986**.

CH 2508: ORGANIC QUALITATIVE ANALYSIS	
Semester – II	No. of credits : 3
Course: Major Core (MC)	No. of hrs : 40 (3 hrs/wk)

Objective

To develop analytical skills in organic qualitative analysis and preparations.

Practicals

1. Determination of melting and boiling points of organic substances.

2. Organic analysis:

   a. Identification of acidic, basic, phenolic, and neutral organic substances.

   b. Detection of N, S and halogens.

   c. Test for aliphatic and aromatic nature of substances.

   d. Test for saturation and unsaturation.

   e. Identification of functional groups:

i) Carboxylic acids	ii) Phenols	iii) Aldehydes	iv) Ketones
v) Esters	vi) Carbohydrates	vii) Amines	viii)Amides
ix) Anilides	x) Nitro	ix) Halogen compounds	

   f. Preparation of derivatives for the functional groups.

Text Book

1. N.S. Gnanapragasam and G. Ramamurthy, *Organic Chemistry – Lab manual*, S. Viswanathan Co. Pvt., **1998**.

References:

2. J.N. Gurthu and R. Kapoor, *Advanced Experimental Chemistry* (Organic), S. Chand and Co., **1987**.

3. B.S. Furniss, A.J. Hannaford, P.W. G. Smith and A.R. Tatchell, *Vogel's Text Book of Practical Organic Chemistry*. 5th Edn., Pearson Education, **2005**.