**Name of the Program: M.Sc Chemistry**

**Humanities and Social Sciences**

**20UC1102-DESIGN THINKING AND INNOVATION – 1**

**L-T-P-S: 1-0-4-0 Credits: 2 Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO No | Course Outcome (CO) | PO/PSO | Blooms Taxonomy Level (BTL) |
|---|---|---|---|
| CO1 | Understand the basics of design thinking and its implications in product or service development | PO1 | 2 |
| CO2 | Understand and Analyse the requirements of a typical problem | PO2 | 4 |
| CO3 | Plan the necessary activities towards solving the problem through ideation and prototyping | PO4, PO5, PO6 | 4 |
| CO4 | Evaluate the solution and refine them based on the customer feedback | PO3, PO5 | 5 |

SYLLABUS:

Overview of Design Thinking: Define Design Thinking, Differentiate Design Thinking from Design, Get an Overview of the Design Thinking Process, Empathize and Understand: Explain how empathy influences the outcomes of Design Thinking, List Different Empathy Research Techniques, Define the Guidelines for an Empathetic Research,Defining Needs: Explain how PoV can be used in defining the design problem, Use a structured approach to arrive at a PoV,Ideation for Solutions: List the best practices for conducting a successful ideating session, Describe the techniques for evaluating and prioritizing ideas, Prototyping: Define prototyping, Explain how prototyping aids in communicating ideas effectively, List various tools for prototyping, Testing the Solution: Define the steps of a successful testing approach, Demonstrate the process of gathering and responding to user feedback.

REFERENCE BOOKS:

1. The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems

**20UC1203-DESIGN THINKING AND INNOVATION – 2**

**L-T-P-S: 1-0-4-0 Credits: 2 Prerequisite: 20UC1102**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO No | Course Outcome (CO) | PO/PSO | Blooms Taxonomy |
|---|---|---|---|

| | | | Level (BTL) |
|---|---|---|---|
| CO1 | Understand the problem statement, requirements and formulating approaches to solve real world problems. | PO1, PO2 | 2 |
| CO2 | Implementing Design Thinking Framework. | PO3 | 5 |
| CO3 | Develop innovative thinking ability through design thinking and also develop metrics for successful implementation of Design Thinking. | PO4, PO5, PO6 | 4 |
| CO4 | Understand the copyright, IPR, Trademark, Patent and license agreement policies for protecting own R&D innovations and enhancing brand image. | PO3, PO6 | 2 |

Syllabus:

Design Thinking for Problem Solving Mindset : Understanding Problem Statements, Recapping Design Principles, Design Thinking Toolsets, Formulating approaches to Solutions, Applications of Design Thinking: Case Study Designing Services : Functional requirements, User requirements, Designing for sustainability and resilience, Case study Designing Thinking for Space and Environment : Functional requirements, user requirements,Implementing Design Thinking Framework,Case study Design Thinking and Innovation Management Culture : How design thinking leads to innovative thinking,Business model thinking,How design Thinking can lead to next generation customer experience,Metrics for successful implementation of Design Thinking Intellectual property and protection of ideas : Concepts of copyright, Intellectual Property,Trademark, Service mark Patent and typical business benefits,Applying for patent,Product license agreement,Open-source license,Need for protecting own R&D innovations,Enhancing brand image with IP

REFERENCE BOOKS:

1. The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems

**PROFESSIONAL CORE**

**19CY5101 – GENERAL CHEMISTRY-I**

**L-T-P-S: 4-0-0-0** **Credits: 4** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Discuss various principles of statistical data treatment to validate analytical results | PO-1,PO-2 | 3 |
| CO2 | Relate suitable chemical reactions to titrations with its mechanism | PO-3, PO-4 | 3 |
| CO3 | Understand the basic principles of Visible spectrophotometry | PO-1, PO-2, | 3 |

| | | | |
|---|---|---|---|
| | and potentiometry to employ them in analytical applications | PO-3 | |
| CO4 | Developing small computer codes to solve basic chemistry problems | PO-2 | 3 |

Syllabus:

**Titrimetric Analysis:** Classification of reactions in titrimetric analysis- Primary and secondary standards-Neutralisation titrations-Theory of neutralisation indicators-Mixed indicators-Neutralisation curves-Displacement titrations-Precipitation titrations-Indicators for precipitation titrations-Volhard method-Mohr method-Theory of adsorption indicators-Oxidation reduction titrations-Change of electrode potentials during titration of Fe(II) with Ce(IV)-Detection of end point in redox titrations-Complexometric titrations-Metal ion indicators-Applications of EDTA titrations-Titration of cyanide with silver ion.**Treatment of analytical data:** Classification of errors - Determinate and indeterminate errors -Minimisation of errors - Accuracy and precision - Distribution of random errors - Gaussian distribution - Measures of central tendency - Measures of precision - Standard deviation - Standard error of mean -student's t test - Confidence interval of mean - Testing for significance - Comparison of two means - F-test - Criteria of rejection of an observation - propagation of errors - Significant figures and Computation rules - Control charts - Regression analysis - Linear least squares analysis.**Visible spectrophotometry and potentiometry:** Beer-Lambert's law-deviations from Beers law-Instrumentation-Applications-Photometric titrations - Spectrophotometric determination of pK value of an indicator - Simultaneous spectrophotometric determinations - Advantages of potentiometric methods -Reference electrode - Standard hydrogen electrode . Calomel electrode -Indicator electrodes: Metal-metal ion electrodes, Inert electrodes, Membrane electrodes, theory of glass membrane potential, Direct potentiometry, potentiometric titrations-Applications.**Programming in Chemistry*:*** Developing of small computer codes using any one of the languages FORTRAN/ C/BASIC involving simple formulae in Chemistry, such as Van der Waals equation. Chemical kinetics (determination of Rate constant) Radioactive decay (Half Life and Average Life). Determination of Normality, Molarity and Morality of solutions. Evaluation Electro negativity of atom and Lattice Energy from experimental determination of molecular weight and percentage of element organic compounds using data from experimental metal representation of molecules in terms of elementary structural features such as bond lengths, bond angles.

TEXT BOOKS:


1. Text Book of Quantitative Chemical Analysis by VOGEL, 2009, Pearson, 6$^{th}$ Edn.
2. Instrumental Methods of Analysis by Willard, Merritt and Dean, 1986 - CBS Publishers, 7$^{th}$ Edn.
3. Chemical Analysis by H. A. Laitinan and W.E.Harris, McGraw Hill.
4. Fundamentals of Analytical Chemistry by Skoog, D.A, West, D.M and Holler, F.J and Crouch, S.R 2007, 8$^{th}$ Edn., Saunders College Publishing.

5. Statistics for Analytical Chemistry by Miller, J.C and Miller, J.N, 1988, Ellis Horwood. Chichester.
6. Analytical Chemistry by Gary D. Christian, 2016, Wiley publisher.
7. Instrumental Analysis by Christian, G.D and J.E. O'Reilly 1986.
8. Instrumental methods of Chemical analysis by Kaur, H, 2001, Pragati Prakashan, 1st Edition, Meerut.
9. Basics of computers for Chemists by P.C.Jurs.

**WEB REFERENCES/MOOCS:**

1. https://drum.lib.umd.edu/bitstream/handle/1903/8434/CPP.pdf;sequence=1
2. https://pubs.acs.org/doi/abs/10.1021/ed049p377?journalCode=jceda8
3. https://www.stat.auckland.ac.nz/~wild/ChanceEnc/Ch13.pdf

## 19CY5102– INORGANIC CHEMISTRY – I

**L-T-P-S: 4-0-6-0** **Credits: 7** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Explain the bonding fundamentals for both ionic and covalent compounds, including electronegativities, bond distances and bond energies using MO diagrams and thermodynamic data | PO-2 | 3 |
| CO2 | Predicting geometries of simple molecules | PO-2 | 3 |
| CO3 | Explain the uses of group theory to recognize and assign symmetry characteristics to molecules and objects, and to predict the appearance of a molecule's vibrational spectra as a function of symmetry | PO-2, PO-3 | 3 |
| CO4 | Illustrate the bonding models, structures, reactivities, and applications of coordination complexes, boron hydrides, metal carbonyls, and organometallics | PO-2, PO-3, PO-5 | 3 |
| CO5 | The design and application of an analysis related to a question of relevance based on experience in the laboratory and research of the scientific literature. | PO-1,2 | 3 |

Syllabus:

Structure & Bonding: Applications of VSEPR, Valence Bond and Molecular orbital theories in explaining the structures of simple molecules- role of p and d orbitals in pi bonding.Application of MO theory to square planar ($PtCl_4^{2-}$) and Octahedral complexes ($CoF_6^{3-}$, $Co(NH_3)_6^{3+}$). Walsh diagram for $H_2O$ molecule.**Inorganic cage and ring compounds** – preparation, structure and reactions of boranes, carboranes, metallocarboranes, boron–nitrogen ($H_3B_3N_3H_3$), phosphorus–nitrogen ($N_3P_3Cl_6$) and sulphur-nitrogen ($S_4N_4$, $(SN)_x$) cyclic compounds.Electron counting in boranes – Wades rules (Polyhedral skeletal electron pair theory).Isopoly and heteropoly acids.

Coordination compounds: Crystal field theory - crystal field splitting patterns in octahedral, tetrahedral, tetragonal, square planar, square pyramidal and trigonal bipyramidal geometries. Calculation of crystal field stabilization energies. Factors affecting crystal field splitting energies

– Spectrochemical series – Jahn – Teller effect, nephelauxetic effect – ligand field theory.Term symbols – Russell – Sanders coupling – derivation of term symbols for various configurations. Spectroscopic ground states.**Electronic spectra of transition metal complexes**: Selection rules, break down of selection rules – Orgel and Tanabe-Sugano diagrams for $d^1$ –$d^9$ octahedral and tetrahedral transition metal complexes of 3d series – Calculation of Dq, B and β parameters. Charge transfer spectra.

***I. Qualitative Analysis***:

Semi- micro analysis of six radical mixtures containing one interfering radical and one less familiar cation each,Interfering anions:Oxalate, tartrate, phosphate, chromate.Less familiar Cations:Thallium, molybdenum, thorium,zirconium,vanadium, uranium. (Minimum three Mixtures).

***Chromatography.***

Separation of cation and anion by paper chromatography (at least one experiment)

TEXT BOOKS:


1. Advanced Inorganic Chemistry by F.A. Cotton and G. Wilkinson, IV Edition, John Wiley and Sons, New York, 1980.
2. Inorganic Chemistry by J.E. Huheey, III Edition, Harper International Edition, 1983.
3. Theoretical Inorganic Chemistry, II Edition by M.C. Day and J. Selbin, Affiliated East-West press Pvt. Ltd., New Delhi.
4. Inorganic Chemistry by Shriver and Atkins, Oxford University Press, 1999.
5. Vogel's Text Books of Qualitative analysis, Revised. J. asset, R.C. Denny, G.H. Jeffery and J.Mendhan. ELBS.
6. Synthesis and Characterisation of Inorganic Compounds by W.L.Jolly. Prentice Hall.


## 19CY5103 – ORGANIC CHEMISTRY – I

**L-T-P-S: 4-0-6-0** **Credits: 7** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Describe the structure and reactivity of chemical constituents of various reaction processes. | PO-1 | 3 |
| CO2 | Apply Nucleophilic Substitution reaction mechanism in the synthesis of desired organic entities. | PO-1,2 | 3 |
| CO3 | Evaluate the properties of organic chemical constituents with respect to their spatial orientation. | PO-1 | 3 |
| CO4 | Adopt the green synthetic approaches for developing conventional and nano materials. | PO-1,2 | 3 |
| CO5 | Knowledge in this course will train the students in scientific research approach. | PO-1,2,3 | 3 |

Syllabus:

Localized and delocalized covalent bond- Concept of resonance and aromaticity- Huckel's rule for aromaticity in benzenoid and non-benzenoid compounds, anti-aromaticity and homo-aromaticity. Nature of reaction energy and kinetic considerations - types of organic reactions-reagents-reactive intermediates. Their formation and stabilization-inductive and mesomeric effects.Stereoisomerism-Stereoisomers Classification – Configuration and conformation.Molecular Three dimensional representations: Wedge, Fischer, Newman and Saw-horse formulae, their description and interconversions.Molecular Symmetry & Chirality: Symmetry operations and symmetry elements (Cn & Sn). Criteria for Chirality. Dissymmetrization.Optical isomerism: Molecular Symmetry and Chirality-Cahn-Ingold-Prelog rules R, S-nomenclature, stereoisomerism resulting from more than one chiral center, meso and pseudoasymmetric compounds - Axial Chirality - Stereochemistry of allenes spiranes - biphenyl derivatives and atropisomerism - Planar chirality - Ansa compounds and trans - Cycloalkenes - Helicity. Helically chiral compounds.Geometrical isomerism-E, Z-nomenclature-Physical and Chemical methods of determining the configuration of geometrical isomers-Stereoisomerism in 3, 4 and 5-membered cyclic compounds.Aliphatic Nucleophilic substitutions: The SN2, SN1, mixed SN1 and SN2, SET mechanisms. Reactivity- effects of substrates, attacking nucleophiles, leaving groups and reaction medium. Common carbocation rearrangements – primary, secondary and tertiary. The neighbouring group participation (NGP) -anchimeric assistance, NGP by $\sigma$ and $\pi$- bonds, phenonium ions, norbornyl and norbornenyl systems, Classical and nonclassical carbocations, NGP by halogens and heteroatoms (O,N,S) The SNi and SN2' mechanisms. Nucleophilic substitution at an allylic, and vinylic carbons. ii. Aromatic Nucleophilic Substitution: The SNAr, SN1, benzyne and SRN1mechanisms. Reactivity - effect of substrate, structure, leaving group and attacking nucleophile. The von Richter, Sommelet - Hauser and Smiles rearrangements. Green Chemistry: Introduction , Basic principles of Green Chemistry, Atom economy, measuring and controlling Environmental performance, Green catalysis, Bio catalysis , Environmentally benign solutions, renewable resources, green reagents, Examples of Green reactions – Synthesis of ibuprofen, clean Fischer – Indole synthesis comparison of the above with conventional methods.Nano chemistry: Introduction, Carbon Nano tubes: Structure of single and multiwalled carbon nano tubes, synthesis –solid and gaseous carbon based production technique, synthesis with Controlled orientation, Growth mechanism (catalyst free growth & catalyst activated growth) of carbon nano tubes, applications.

Identification organic compounds: Phenol, base, organic acid, ketone, aldehyde, amide and carbohydrate with preparation of two solid derivatives.

**Text Books:**


1. Advanced Organic Chemistry-Reactions, Mechanism and Structure by Jerry March, John Wiley
2. Advanced Organic Chemistry by F.A. Carey and R.J Sundberg, Plenum.
3. Structure and Mechanism in Organic Chemistry by C.K.Inglod, Cornell University Press.
4. Organic Chemistry by R.T Morrison and R.N. Boyd, Prentice - Hall.

5. Principles of Organic Synthesis by R.O.C Norman and J. M. Coxon, Blackie Academic
6. Stereochemistry by P.S.Kalsi, Wiley Eastern.
7. Text book of Organic Chemistry by M.C. Murry
8. Organic Chemistry by I.L.Finar, Vol. 1, ELBS Eds.
9. Organic Chemistry by I.L. Finar, Vol. I (Sixth Edn.) and Vol. II (Fifth Ed.,) ELBS.
10. Organic Chemistry by Morrison and Boyd, (Fifth Edn.,), PHI, India.
11. Organic Chemistry by Francis A. Carey (Fifth edition),Tata Mc Graw Hill publishing company Limited, New Delhi.
12. Reaction Mechanism in Organic Chemistry by Mukherjee Sirigh, NTerniitarr, India.
13. A guide book to Mechanism in Organic Chemistry by Peter Sykes, ELBS.
14. Green Chemistry: Theory and Practice by P.T. Anastas and J.C. Warner. Oxford University Press.
14. Green Chemistry: Introductory Text by M. Lancaster Royal Society of Chemistry
15. Nanomaterials and Nanochemistry by Br'echignac C., Houdy., and Lahmani M. (Eds.) Springer Berlin Heidelberg New York. 2007.
16. Nano particle Technology Handbook by M. Hosokawa, K. Nogi, M. Naito and T.Yokoyama (Eds.) First edition 2007. Elsevier

Reference Books:

1. Advanced organic chemistry by Jerry March (4th Edition) Wiley Eastern.
2. Chemistry of Natural Products by K.W.Bentley
3. Stereochemistry of carbon compounds by E.Eliel, John Wiley & Sons, Inc.
4. Stereochemistry of Organic compounds by D. Nasipuri
5. Chemistry of Natural products by P.S. Kalsi Kalyani Publishers, 1983.

**19CY5104 – PHYSICAL CHEMISTRY – I**

**L-T-P-S: 4-0-6-0 Credits: 7 Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Understand the concepts of Classical thermodynamics & laws of thermodynamics | PO-1, PO-2 | 3 |
| CO2 | Understand the applications of Surfactants and Macromolecules | PO-2 | 3 |
| CO3 | Discuss the different aspects of kinetics of the types of reactions s. | PO-2,3,4 | 3 |
| CO4 | Understand the concepts of photo chemistry & luminescence | PO-2,3,4 | 3 |
| CO5 | An ability to analyze, generate experimental skills towards the industrial applications. | PO-1,2 | 3 |

Syllabus:

**Thermodynamics:** Chemical equilibrium- effect of temperature on equilibrium constant-Van't Hoff equation. Partial molar quantity- different methods of determination of partial molar quantity. Chemical potential- Phase rule and its derivation, Gibbs-Duhem equation, Duhem-Margules equation, Classius-Clapeyron equation. Nernst heat theorem. Third law of thermodynamics- Determination of the absolute entropy- Apparent exceptions to Third law of thermodynamics.**Micelles and Macromolecules:** Surface active agents, classification of surface

active agents, micellization, hydrophobic interaction, critical micelllar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization- phase separation and mass action models, solubilization, micro emulsion, reverse micelles.**Polymers**- Definition, types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of polymerization. Molecular mass- Number and mass average molecular mass, molecular mass determination- Osmometry, viscometry, diffusion and light scattering methods. Sedimentation, chain configuration of macromolecules, calculation of average dimensions of various structures. **Chemical Kinetics**: Theories of reaction rates- Collision theory- Limitations, Transition state theory. Effect of ionic strength- Debye Huckel theory-Primary and secondary salt effects. Effect of dielectric constant, effect of substituent, Hamett equation -limitations- Taft equation. Consecutive reactions, parallel reactions, opposing reactions (Uni molecular steps only, no derivation). Specific and general acid-base catalysis. Skrabal diagram. Fast reactions- different methods of studying fast reactions- flow methods, relaxation methods- temperature jump and pressure jump methods. **Photochemistry**: Electronic transitions in molecules, Franck-Condon principle.Electronically excited molecules- singlet and triplet states, spin-orbit interaction. Quantum yield and its determination. Actinometry. Derivation of fluorescence and phosphorescence quantum yields. Quenching effect- Stern Volmer equation. Photochemical equilibrium and delayed fluorescence- E type and P type. Photochemical primary processes, types of photochemical reactions-photo dissociation, addition and isomerization reactions with examples.

List of Experiments:

1. Determination of rate constant of the oxidation of iodide ion with persulphate ion.
2. Relative strengths of acids by studying the hydrolysis of ethylacetate / methyl acetate
3. Determination of equilibrium constant of $KI_3 \leftrightarrow KI + I_2$ by partition coefficient method and determination of unknown concentration of potassium iodide.
4. Distribution coefficient of Benzoic acid between Benzene and water.
5. Determination of critical solution temperature of phenol-water system Study of the effect of electrolyte on the miscibility of phenol-water system.

TEXT BOOKS:

1. Physical Chemistry by Peter Atkins and Julio de Paula, Oxford University Press.
2. Physical Chemistry by G.W. Castellon, Narosha Publishing House
3. Physical chemistry by K.L. Kapoor

REFERENCE BOOKS:

1. Thermodynamics for Chemists by Samuel Glasstone
2. Chemical Kinetics by K.J.Laidler, McGraw Hill Pub.
3. Photochemistry by R.P. Kundall and A. Gilbert, Thomson Nelson.
4. Introduction to Polymer Science by V.R. Gowriker, N.V.Viswanadhan and J. Sreedhar.,Wiley Easter.
7. Micelles - Theoretical and applied aspects by V.Moroi, Plenum publishers.

**19CY5201 - GENERAL CHEMISTRY – II**

**L-T-P-S: 4-0-0-0** **Credits: 4** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Describe symmetry elements, operations and groups by representing them in matrices | PO-1, PO-2, PO-3 | 3 |
| CO2 | Demonstrate various molecular spectroscopic terms with their theoretical background | PO-1,PO-2 | 3 |
| CO3 | Apply the basic principles of classical and quantum theory of Raman spectroscopy in analytical applications | PO-1, PO-2 | 3 |
| CO4 | Employ Nuclear magnetic resonance spectroscopy to interpret organic molecules | PO-1, PO-2 | 3 |

Syllabus:

**Symmetry and Group theory in Chemistry** - Symmetry elements, symmetry operation, definition of group, suib group, relation between order of a finite group and its sub group. Point symmetry group. Schonfiles symbols, representation of groups by Matrices (representation for the Cn, Cnv, Cnh, Dn etc.groups to be worked out, explicitely). Character of a representation. The great orthogonality theorem(without proof) and its importance. Character tables and their use. Application of group theory in IR and Raman spectroscopy.**Motion of molecules-Degrees of freedom** –Energy associates with the degrees of freedom Type of spectra Microwave spectroscopy. Classification molecules, rigid rotator model, effect of isotopic substitution on the transition frequencies, Intensities non-rigid rotator-Microwave spectra of polyatomic molecules. Infared spectroscopy Harmonic oscillator, vibrational energies of diatomic molecules, zero point energy, force constant and bond strengths, anhoremonicity Morse potential energy diagram. Vibration – rotation spectroscopy. PQR braches, Born – oppenheimer approximation, Break down Born – openheimer approximation, selection rules, normal modes of vibration group frequencies, overtones, hot bands, application of IR spectra to polyatomic molecules.**Raman spectroscopy.** Classical and quantum theories of Raman effects, pure rotational, vibrational and Vibrational – rotational Raman spectra, selection rules, mutual exclusion principle, Resonance Raman spectroscopy, coherent antistrakes Raman Spectroscopy (CARS) – Application. Visible and ultraviolet spectroscopy: - Electronic Spectra of diatomic molecules, vibrational structure of an electronic transition, classification of bands, rotational fine structure of electronic vibrational transition. Electronic Spectra of Polyatomic Molecules – Instrumentation – Applications.**Nuclear Magnetic Resonance Spectroscopy**: - Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shift and its measurements, factors influencing chemical shift, desheilding, spin – spin interactions, factors influencing, coupling constant J.

**Text Books:**

1. Fundamentals of Molecular spectroscopy by C.N.Banwell
2. Introductory Group Theory for Chemists by George Davidson

3. Group theory for chemistry by A.K.Bhattacharya
4. Molecular spectroscopy by B.K.Sharma
5. Vibrational Spectroscopy by D.N.Sathyanarayana New Age Int. Pub.
6. Spectroscopy by Aruldas.
7. Chemical Analysis by H.A.Laitinan and W.E.Harris, McGraw Hill.

**19CY5202 – INORGANIC CHEMISTRY-II**

**L-T-P-S: 4-0-6-0 Credits: 7 Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Understand the principles behind the formation of metal cluster compounds. | PO-1, 3 | 3 |
| CO2 | Explain the synthesis, properties, bonding and structures of π-complexes of transition metals, | PO-1, 4 | 3 |
| CO3 | Illustrate the principles behind the Metal Ligand equilibria in solution with respect to the formation, their Kinetic and thermal stability, and determinations. | PO-1, 3 | 3 |
| CO4 | Explain the features of Inorganic reaction mechanisms | PO-1,4 | 3 |
| CO5 | Ability to prepare complex compounds and determine the concentrations | PO-1,6 | 3 |

Syllabus:

**Metal cluster compounds -** definition – evidences for existence of M-M bonds - conditions favorable for formation of M-M bonds – preparation, structure and bonding of the following metal cluster compounds.$Re_2Cl_8^{2-}$, $Mo_2Cl_8^{4-}$, $Re_2(RCOO)_4X_2$, $Mo_2(RCOO)_4(H_2O)_2$, $Cr_2(RCOO)_4(H_2O)_2$, $Cu_2(RCOO)_4$ $(H_2O)_2$, $Cr_2Cl_9^{3-}$, $Mo_2Cl_9^{3-}$, $W_2Cl_9^{3-}$, $Re_3Cl_9$, $Re_3Cl_{12}^{3-}$, $Mo_6Cl_8^{4+}$, $Nb_6X_{12}^{2+}$ and $Ta_6X_{12}^{2+}$. Polyatomic clusters – Zintle ions, Chevrel phases.**Organometallic compounds -** 16 and 18 electron rules. Isoelectronic relationship - Synthesis, structure, bonding and reactions of carbon monoxide, dinitrogen and nitric oxide complexes.Isolobal relationship – H, Cl, $CH_3$, $Mn(CO)_5$; S, $CH_2$, $Fe(CO)_4$; P, CH, $Co(CO)_3$ Synthesis, structure, bonding and reactions of metallocenes with special reference to ferrocene **Metal Ligand equilibria in solution** Step wise and overall formation constants and their interaction – trends in stepwise constants – factors affecting the stability of metal complexes – Pearson's theory of hard and soft acids and bases (HSAB), chelate effect and its thermodynamic origin, determination of stability constants of complexes.**Metal Ligand equilibria in solution:**Spectrophotometric method and pH –metric method. Reactivity of metal complexes – inert and labile complexes. Explanation of lability on the basis of valence bond and crystal field theories. **Inorganic Reaction Mechanisms** Substitution reactions of metal complexes – D, Id, Ia and A mechanisms Ligand replacement reactions of metal complexes – Acid hydrolysis – factors affecting acid hydrolysis – Anation and Base hydrolysis of Cobalt(III) complexes. Ligand displacement reactions of square planar complexes of platinum (II).**Inorganic Reaction Mechanisms** Factors affecting square planar substitution – trans effect (theories). Electron transfer reactions of complexes – concept of

complementary and non-complementary reactions with examples. Inner and outer sphere mechanisms.

***compounds:***

a) Potassium trisoxalate ferrate (III).b) Mercury tetrathiocyanate cobalate (II).c) Tris thiourea copper (1) sulphate.d) Cis and trans potassium diaquo dioxalato chromium (III).e) Hexa ammine cobalt (III) chloride.f) Nitro and Nitrite pentaammine Cobalt III chloride (Minimum four Preparation)

Quantitative analysis:

1) Determination of $Zn^{2+}$ with potassium ferrocyanide (Volumetric)
2) Complexomatric titrations: Determination of Mg2+, Ni2+and hardness of water using EDTA.
3) Determination of $Fe^{3+}$ by photochemical reduction.
4) Argentometry: Determination of chloride by argent metric titration using a)$K_2CrO_4$
5) Fluorescein as indicators.
6) Determination of nickel using dimethyl glyoxime, "Cupper using ammonium thicyanate, Zn using di ammonium hydrogen phosphate – gravimetrically (Minimum two Gravimetric experiments)

**TEXT BOOKS:**


1. Advanced Inorganic Chemistry by F.A. Cotton and R.G. Wilkinson, IV Edition, John, John Wiley and Sons, New York, 1980.
2. Inorganic Chemistry by J.E. Huheey, III edition, Harper International Edition, 1983.
3. Organometallic Chemistry-A unified approach by A. Singh and R.C. Mehrotra, Wiley Eastern Ltd.
4. Inorganic Chemistry by Shriver and Atkins, Oxford University Press (1999)
5. Theoretical Inorganic Chemistry, II Edition by M.C. Day and J. Selbin, Affiliated East-West press Pvt. Ltd., New Delhi.
6. Mechanisims of Inorganic reactions in solution by D.Benson, MCgraw Hill, London, 1968.
7. Inorganic chemistry by K.F. Purcell and J.C.Kotz, W.B. Saunders company, New York, 1977.
8. Vogel's Text Books of Qualitative analysis by J. Asset, R.C. Denny, G.H. Jeffery and J.Mendhan. ELBS.
9. Synthesis and Characterisation of Inorganic Compounds by W.L.Jolly, Prentice Hall.
10. Practical Inorganic Chemistry by G. Pass and H. Sutcliffe Chapman and Hall.
11. Practical Inorganic Chemistry by. K. Somasekhar Rao and K.N.K. Vani.


## 19CY5203 – ORGANIC CHEMISTRY – II

**L-T-P-S: 4-0-6-0** **Credits: 7** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Derive the Electrophilic addition reaction mechanisms of C=C compounds | PO-1,4 | 3 |

| | | | |
|---|---|---|---|
| CO2 | Describe the relationship among aromatic substitution and addition reactions. | PO-2,3 | 3 |
| CO3 | Apply various reaction pathways to develop new and notable organic compounds. | PO-1,5 | 3 |
| CO4 | Differentiate the Alkaloids and Terpenoids by their unique properties. | PO-1,6 | 3 |
| CO5 | An ability to analyze, generate experimental skills towards the industrial applications. | PO-1,2 | 3 |

Syllabus:

Electrophilic addition to carbon carbon double bond: Stereoselective addition to carbon carbon double bond; anti addition- Bromination and epoxidation followed by ring opening. Syn addition of $OsO_4$ and $KMnO_4$. Elimination reactions Elimination reactions $E_2$, $E_1$, $E_{1CB}$ mechanisms. Orientation and stereoselectivity in $E_2$ eliminations. Pyrolytic syn elimination and α-elimination, elimination Vs substitution. Factors influencing the elimination reactions Aromatic substitution reactions- electrophilic, nucleophilic and through benzynes - radical substitution of arenes - orientation of nucleophilic substitution at a saturated carbon.

SN1, SN2, SNi reactions-effect of structure, nucleophile, leaving group, solvent. Additions involving electrophiles, nucleophiles and free radicals. Elimination reactions - $E_l$, $E_1CB$, $E_2$ reactions – elimination versus substitution reactions. Mechanism of some name reactions: Aldol, Perkin, Benzoin, Cannizaro, Wittig, Grignard, Reformatsky - Meerwein, Hoffmann Claisen and Favorsky rearrangements. Hydroboration - Openauer oxidation, clemmensen reduction. Meerwein - Pondorf and verley and Birch reductions. Stork enamine reactions, Michael addition, Mannich Reaction, Diels -Alder reaction, Ene - reaction, Bayer - Villiger Reaction. Occurrence, isolation, general methods of structure elucidation and physiological action, degradation, classification based on nitrogen heterocyclic ring, structure elucidation and synthesis of the following: Atropine, Papaverine and Quinine. Classification of terpenoids, occurrence, isolation, general methods of structure determination.Isoprene and special isoprene rule. Structure determination and synthesis of the following representative molecules: Farnesol, Zingeberine, Cadinene and Abietic acid.

LAB:

Preparations: i) Iodoform ii) n-Dinitroderivative iii) Asprin iv) p-Nitroaniline v) Bezophenone vi) Benzoic acid vii) p-Bromo Acetanilide viii) Acetanilide

Identification of given two compounds with preparation of two solid derivatives and reporting of the melting points for derivatives

One preparation – Yield of crude and crystallized sampled and reporting of the melting point.

**TEXT BOOKS:**


1. Advanced Organic Chemistry-Reactions, Mechanism and Structure by Jerry March, John Wiley.
2. Advanced Organic Chemistry by F.A. Carey and R.J Sundberg, Plenum.
3. Structure and Mechanism in Organic Chemistry by C.K.Inglod, Cornell University Press.
4. Organic Chemistry by R.T Morrison and R.N. Boyd, Prentice - Hall.
5. Modern Organic Reactions by H.O. House, Benjamin.

6. Principles of Organic Synthesis by R.O.C Norman and J. M. Coxon, Blackie Academic.
7. Stereochemistry by P.S.Kalsi, Wiley Eastern.
8. Text book of Organic Chemistry by M.C. Murry
9. Organic Chemistry Vol. I (Sixth Edn.) and Vol. II (Fifth Ed.,) by IL Finar ELBS.

**REFERENCE BOOKS:**

1. Advanced organic chemistry by Jerry March (4th Edition) Wiley Eastern. .
2. Chemistry of Natural Products by K.W.Bentley.
3. Stereochemistry of carbon compounds by E.Eliel, John Wiley & Sons, Inc.
4. Stereochemistry of Organic compounds by D. Nasipuri.
5. Chemistry of Natural products by P.S. Kalsi, Kalyani Publishers. 1983.

## 19CY5204 – PHYSICAL CHEMISTRY-II

**L-T-P-S: 4-0-6-0** **Credits: 7** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Physical methods of molecular structure determination. | PO-1,2 | 3 |
| CO2 | Application of Electron Spin Resonance spectroscopy. | PO-1,2,3 | 3 |
| CO3 | Discuss fundamental aspect of electrochemistry for energy device application. | PO-1,2,3 | 3 |
| CO4 | Electrochemistry of electrode electrolyte interface | PO-1,4,5 | 3 |
| CO5 | An ability to analyze, generate experimental skills towards the industrial applications. | PO-2,6 | 3 |

Syllabus:

**Physical methods of molecular structural elucidation:** Magnetic properties of molecules-theories of magnetic susceptibility- measurement of magnetic susceptibility. Principle and theory of NMR spectroscopy- Nature of spinning particle and its interaction with magnetic field. Chemical shift and its origin. Spin-Spin interaction-experimental methods.Application of NMR to structural elucidation- Structure of ethanol, dimethylformamide,styrene and acetophenone.**Electron Spin Resonance**: Principle and experimental technique- g-factor, line shapes and line widths- hyperfine interactions- applications of ESR studies to the structure of free radicals, metal complexes and biological systems. **Electrochemistry I**: Electrochemical cell-Galvanic and electrolytic cell. Concentration cell with and without transference- effect of complexation on redox potential- ferricyanide/ferrocyanide couple, Iron(III) phenonthroline/ Iron(II) phenonthroline couple. Determination of standard potential. Activity coefficient from EMF data. Primary and secondary cells, batteries examples. Fuel cells. The electrode-electrolyte interface. The electrical double layer. The Helmholtz-Perrin parallel-plate model, the Gouy-Chapman diffuse-charge model and the Stern model.**Electrodics**: Charge transfer reactions at the electrode-electrolyte interface. Exchange current density and overpotential. Derivation of

Butler-Volmer equation. High field approximation, Tafel equation, Low field equilibrium, Nernest equation. Voltametry-Concentration polarization, experimental techniques.

List of experiments:

1. Potentiometric determination of Fe(II) with Cr (VI)
2. Potentiometric titration of chloride with silver nitrate.
3. pH-metric determination of strong acid with strong base.
4. Conductometric titration of strong acid with strong base
5. Verification of Beers Law using potassium permanganate/Potassium dichromate.
6. Determination of formulae and stability constant of a metal complex by spectrophotometric method.
7. Verification of Langmuir isotherm . Determination of unknown concentration of acetic acid by studying its adsorption on activated charcoal.

**TEXT BOOKS:**

1) Physical Chemistry by Peter Atkins and Julio de Paula, Oxford University Press.
2) Physical Chemistry by G.W. Castellon, Narosa Publishing House
3) Physical chemistry by K.L. Kapoor

**REFERENCE BOOKS:**

1) Introduction to Electrochemistry by S.Glasstone.
2) Fundamentals of Molecular Spectroscopy by Banwell
3) Spectroscopy by Barrow.

## 19CY5301- INSTRUMENTAL METHODS OF ANALYSIS-I

**L-T-P-S: 4-0-6-0** **Credits: 7** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Understand the concepts of excitation spectroscopic methods. | PO-1,2 | 3 |
| CO2 | Understand the basic concepts of rotational and vibrational spectroscopic methods. | PO-3,4 | 3 |
| CO3 | Illustration of the concept of Nuclear magnetic and ESR spectroscopy and their applications. | PO-1,3 | 3 |
| CO4 | Comprehend the basic knowledge of mass spectroscopy and X-ray spectroscopy to characterize the unknown molecules | PO-1,2,5 | 3 |
| CO5 | Ability to analyze chemicals by Instrumental methods | PO-1,5 | 3 |

Syllabus:

**UV-Visible Spectroscopy**: laws of absorption, deviation from Beer's law, single and double beam spectrophotometers-instrumentation, sources of radiation, detectors, qualitative analysis by absorption measurements, general precautions in colorimetric determinations, determination of certain metal ions by using ligands – $Fe^{2+}$, $Fe^{3+}$, $Al^{3+}$, $NH^{4+}$, $Cr^{3+}$, $Cr^{6+}$, $Co^{3+}$, $Cu^{2+}$,

$Ni^{2+}$ and anions – $NO^{2-}$, $PO_4^{3-}$ using suitable reagents, simultaneous determinations of dichromate and permanganate in a mixture, spectrophotometric titrations, principle of diode array spectrophotometers. **Spectrofluorimetry:** Theory of fluorescence, phosphorescence, factors affecting the above, quenching, relation between intensity of fluorescence and concentration, instrumentation, application with reference to $Al^{3+}$, chromium salts, fluorescence, thiamin (B1) and riboflavin (B2) in drug samples.**Chemiluminescences:** Introduction, principle, types Measurement of chemiluminescence, Instrumentation quantitative chemiluminescences Gas phase chemiluminescence's analysis Chemiluminescences titrations, Electro-chemiluminescence.**Infrared spectroscopy:** Units of frequency, wavelength and wave number molecular vibrations, factors influencing vibrational frequencies, instrumentation, sampling techniques, detectors, characteristic frequencies of organic molecules, qualitative and quantitative analysis with reference to (petroleum refinery and polymer industry), selected molecules like CO, $CO_2$, non-destructive IR method for the analysis of CO and other organic compounds, principles of Fourier transform IR.**Mass Spectroscopy:** Principle, basic instrumentation, energetics of ion formation, types of peaks observed, resolution, qualitative analysis, molecular weight determination, quantitative analysis, advantages. **X-ray Spectroscopy:** chemical analysis by X-ray spectrometers, energy dispersive and wavelength dispersive techniques, evaluation methods, instrumentation, matrix effects, applications.**An Introduction to Microscopy (surface characterization techniques)** Limitations of the Human Eye, the X-ray Microscope, The Transmission Electron Microscope, The Scanning Electron Microscope, Scanning Transmission Electron Microscope, Analytical Electron Microscopy, Scanning-Probe Microscopes, the transmission electron microscope.

**List of Experiments:**

1. Determination of alkalinity in a colored effluent using pH metric end point
2. Determination of purity of commercial HCl, $H_2SO_4$, $H_3PO_4$ and $CH_3COOH$ using pH metric end point
3. Determination of Cr (VI) with Fe (II) using potentiometric end point
4. Determination of a mixture of Ce (IV) and V (V) with Fe (II) using potentiometric end point
5. Determination of a mixture of Mn (VII) and V (V) with Fe (II) using potentiometric end point
6. Determination of a mixture of bromide and chloride with $AgNO_3$ using potentiometric end point
7. Determination of KSCN with $AgNO_3$ using potentiometric end point
8. Estimation of aspirin from given tablet by spectrophotometry
9. Determination of Strength of commercial phosphoric acid by potentiometric titrations using standard solution of sodium hydroxide
10. To determine chloride and iodide from given mixture by potentiometry
11. Analysis of Riboflavin from vitamin supplementary capsules / syrup / tablet sample by Photoflurometry
12. Determination of relative strength of acetic acid, chloroacetic acid and trichloroacetic acid through measuring their Ka value by conductivity measurement method
13. Determination of commercial vinegar by potentiometric titration.
14. Determination of boric acid by conductometry.

15. Estimation of micronutrient from food by AAS (any two elements such as Fe, Cu, Zn, Mo, B, Mn)

**TEXT BOOKS:**

1) Instrumental methods of analysis by H.H Willard, Meritt Jr. and J.A Dean
2) Principles of instrumental analysis by Skoog and West
3) Vogels Textbook of Quantitative Inorganic analysis by J. Basset, R.C Denney, G.H Jefferey and J.Madhan
4) Instrumental methods of analysis by B.K Sarma, Goel Publishing House, Meerut
5) Instrumental methods of Analysis by Chatwal and Anand
6) Instrumental methods of Analysis by Ewing

**REFERENCE BOOKS:**

1) Introduction to instrumental analysis by R. D. Braun, Mc Graw Hill - International edition.
2) Analytical spectroscopy by Kamalesh Bansal, 1st edition.
3) Instrumental methods of chemical analysis by Willard, Dean and Merittee- 6th edition.
4) Analytical chemistry principles by John H. Kenedey- 2nd edition, Saunders college publishing.
5) Spectroscopic identification of organic compounds Fifth Edition by Silvestrine, Bassler, Morrill, John Wiley and sons.
6) Analytical Chemistry by Kellner, Mermet, otto, Valcarcel, Widmer, Second Ed. Wiley –VCH
7) Vogel's Textbook of quantitative Chemical Analysis, sixth Edition by Mendham, Denney, Barnes, Thomas, Pub: Pearson Education.
8) Electron Microscopy in the study of Material by P. J Grundy and G. A Jones.

## 19CY5302- QUALITY CONTROL AND TRADITIONAL METHODS OF ANALYSIS-I

**L-T-P-S: 4-0-0-0** **Credits: 4** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Understand the principles of Quality control in Analytical Chemistry | PO-1,3 | 3 |
| CO2 | Explain the various concepts of decomposition techniques in analysis | PO-1,4 | 3 |
| CO3 | Illustrate, discuss and apply the various principles behind the various Redox systems involved in the classical Volumetric methods of Analysis. | PO-1,3 | 3 |
| CO4 | Explain the various principles involved in the analysis of Organic Functional Groups | PO-1,2,5 | 3 |

Syllabus:

**Characteristics of an analysis:** quality of an analytical procedure, limit of detection, sensitivity, safety, cost measurability, selectivity and specificity, quality control-principles of Ruggedness test, control charts, Youden plot, and ranking test. **Evaluation and reliability of analytical data:** limitation of analytical methods, accuracy, precision, errors in chemical analysis, classification of

errors, minimization of errors, significant figures, computations and propagation of errors. Statistical analysis: Mean deviation, Standard deviation, coefficient of variance, normal distribution, F test, T test, rejection of results, presentation of data. **Quality assurance and management systems:** elements of quality assurance, quality assurance in design, development, production and services, quality and quantity management system, ISO 9000 and ISO 14000 series-meaning of quality, quality process model, customer requirement of quality calibration and testing, statistical process control, process control tools, control chart, statistical quality control, acceptance sampling. Good laboratory practices (GLP) – need for GLP, GLP implementation and organization, GLP status in India. Brief out line of ICH guide lines on drug substances and products.**Decomposition techniques in analysis:** Principle of decomposition and Dissolution. Difference between dissolution / decomposition of Organic and Inorganic substances. Prinicples of decomposition techniques in Analysis. Decomposition of samples with acids – $H_2O$, HCl, HF, $HNO_3$, $H_2SO_4$ and $HClO_4$ Decomposition of samples by fusion, Alkali Fusion-$Na_2CO_3$, NaOH, Acidic Fusion-Sodium Hydro Sulphate, Sodium Pyro Sulphate Oxidation Fusion-$Na_2O_2$, Sodium Chlorate Reductive Fusion $Na_2CO_3$ + $Na_4BO_4$, Sintering process, Fusion with alkali carbonates, alkali hydroxides, Sodium Peroxide Decomposition of samples by sintering with sodium peroxide, sodium carbonate, Principles of decomposition at high temperatures, high pressures, Principles of Microwave and ultrasonic decomposition techniques.Organic Compounds Principles of solubility of organic compounds, non polar, polar solvents. Recrystallisation methods and application of solubility and Recrystallisation.Oxidant systems – Principles and applications in analysis Applying the Analytical chemistry of some selected oxidant systems – formal, standard and normal potentials in various media, species responsible for the oxidation properties, stability of the solutions, standardization, requirement for the selections of the oxidants, selection of suitable indicators for Oxidant systems.a) Inorganic Systems Mn (III), Mn (VII), Ce (IV), Cr (VI), V (V), periodate, iodate,b) Organic Systems chloramine-T.Organic Functional group analysis: Classification of functional groups with suitable examples. Determination of: Functional groups imparting acidic nature – thiol, enediol, phenolic hydroxyl. Functional groups imparting basic nature – Aliphatic and Aromatic primary, secondary and tertiary amines – hydrazine derivatives. Functional groups which impart neither acidic nor basic nature – Aldehydes, Ketones, Nitro, Methoxy, Olifinic.

**TEXT BOOKS:**


1. Technical methods of analysis by Griffin, Mc Graw Hill Book Co.
2. Chemical Separation and measurements by D.G Peterseti, John M.Haves Sanders Co.
3. Chemical analysis by H.A Laitinan, Mc Graw Hill Book Co.
4. Newer redox titrants by Berka, Zyka and Vulterin, Pergamon Press
5. Volumetric Analysis, Vol III by I.M Kolthoff and R. Belcher, Interscience Public, New York
6. Vogel's Text Book of Inorganic Quantitative Analysis by J. Bassett et al, ELBS
7. Organic functional groups by S. Siggia


**REFERENCE BOOKS:**


1. Analytical Chemistry, An Introduction by D.A Skoog, D.M West and F.J Holler, Sanders College Publishing, New York.
2. Environmental Management by K.V.S.G Murali Krishna, An Introduction ISO 9000, ISO 1400 Series, Quality Assurance and Good Laboratory Practices by Prof. Y. Anjaneyulu, In Now Publication, New York
3. Quality Assurance in Analytical Chemistry by G.Kateman and F.W Pijpers, John Wiley and Sons, New York

4. Quantitative Chemical Analysis by I.M Kolthoff, E.B Sandel, E.J Meehan, S. Bruckenstein, Macmillan Company, London
5. Decomposition Techniques in Inorganic Analysis by J.Dolezal, P.Povondra, Z.Sulcek

**19CY5303- APPLIED ANALYSIS-I**

**L-T-P-S: 4-0-6-0** **Credits: 4** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Understand the principles, methodology and adoptability various procedures for the analysis of Analysis of Iron, Manganese, Chromite , Phosphate and Aluminium Ores | PO-1,2 | 3 |
| CO2 | Discuss, explain and illustrate the applications of the general methods of analysis for finished products such as Steel, dolomite, fire clay, four spar and magnesite | PO-1,3 | 3 |
| CO3 | Finding the adoptability by applying the general methods of analysis for Cement, Soaps, Oils and paints analysis | PO-1,2,4 | 3 |
| CO4 | Explain and apply the various principles involved in the chemical and physicochemical analysis of Organic Functional Groups | PO-1,4,5 | 3 |
| CO5 | Analysis of chemicals by instrumental methods | PO-1,2 | 3 |

Syllabus:

Analysis of Ores: General techniques of analysis applied to complex materials - Scope of metallurgical analysis-General methods of dissolution of complex materials - Various chemical methods for the effective separation of the constituents in the complex materials. Analysis of ores: Iron ore- Analysis of the Constituents – Moisture , loss of ignition, Total Iron, ferrous Iron, Ferric Iron, alumina, silica, Titania, Lime, Magnesia, Sulphur, phosphrous, manganese, alkalies, combined water, Carbon in blast furnace, flue dust and sinter. Manganese Ore-Analysis of the Constituents– Total Manganese, $MnO_2$, $SiO_2$, BaO, $Fe_2O_3$, $Al_2O_3$, CaO, P and S Chromite Ore - Analysis of the Constituents-Chromium, $SiO_2$, FeO, $Al_2O_3$ CaO, & MgO. Phosphate rock Ore - Analysis of the Constituents-CaO, $P_2O_5$, F, $SiO_2$, $CO_2$, S, $Na_2O$, $Al_2O_3$, $Fe_2O_3$, Mgo, $K_2O$, Cl, MnO. Organic carbon, Moisture, Loss of ignition.Aluminium Ore (Bauxite)-Analysis of the Constituents-Silica, Alumina, $Fe_2O_3$, Titania, MnO, $P_2O_5$, CaO, MgO, vanadium, zirconium, and alkalies. Analysis of Finished Products: Analysis of steel for C, Si ,S, P, Mn, Ni, Cr; Mg and analysis of blast furnace slag. Analysis of refractory materials: fire clay, flour spar, and magnesite Analysis of fluxes - limestone and dolomite. Chemical Analysis of cement-silica, $NH_4OH$ group, ferric oxide, alumina, lime, magnesia, Sulphide Sulphur , $K_2O$,$Na_2O$, free CaO in Cement and Clinker, $SO_3$ and loss on ignition. Analysis of oils- saponification number, iodine number, and acid number.Analysis of soaps - moisture, volatile matter, total alkali, total fatty matter, free caustic alkali or free fatty acids, sodium silicate, chloride. Analysis of paints-vehicle and pigment, $BaSO_4$, total lead and lead chromate. Assessment of water Quality: Sources of water, classification of water for different uses, types of water pollutants and their effects, Analytical methods for the determination of the following ions in water: Anions: $CO_3^{2-}$,

$HCO^{3-}$, $F^-$, $Cl^-$, $SO_4^{2-}$, $PO_4^{3-}$, $NO^{3-}$, $NO^{2-}$, $CN^-$, $S^{2-}$Cations: $Fe^{2+}$, $Fe^{3+}$, $Ca^{2+,}$ $Mg^{2+}$, $Cr^{3+}$, $As^{5+}$, $Pb^{2+}$, $Hg^{2+}$, $Cu^{2+}$, $Zn^{2+}$, $Cd^{2+}$, $Co^{2+}$ Determination of Dissolved oxygen (D.O), Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), standards for drinking water.

List of Experiments:

**Water analysis**

(i) Analysis of water for total hardness ($Ca^{2+}$ and $Mg^{2+}$)

(ii) Analysis of water for chloride ($Cl^-$)

(iii) Analysis of water for alkalinity ($CO_3^{2-}$, $HCO_3^-$)

(iv) Analysis of dissolved oxygen (DO) in drinking water and sewage water

(v) Analysis of chemical oxygen demand (COD) in drinking water and sewage water

**Fertilizer analysis**

(i) Analysis of fertilizer for ammonia, nitrate and phosphate

**Analysis of iron ore**

(i) Complete analysis of iron ore

(ii) Analysis of iron ore (with special reference to percentages of Fe (II) and Fe (III) present in the sample)

**TEXT BOOKS:**


1. Handbook of Analytical Control of Iron and Steel Production by Harrison John, Weily 1979
2. Standard methods of Chemical Analysis by Welcher
3. Technical Methods of Analysis, Griffin by Mc Graw Hill
4. Commercial Methods of Analysis by Foster Dee Sneel and Frank M. Griffin, Mc Graw Hill Book Co.
5. Water Pollution, Lalude by Mc Graw Hill
6. Environmental Chemistry by Anil Kumar De, Wiley Eastern Ltd.
7. Environmental Analysis by S.M. Khopkar (IIT Bombay)


## 19CY5310 -ORGANIC SYNTHESIS- I

**L-T-P-S: 4-0-6-0** **Credits: 7** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Build carbon-carbon single bond associated molecules (carbenes-carbenoids) | PO-2,4 | 3 |
| CO2 | Develop carbon-carbon double bonds using notable elimination reactions | PO-2,3 | 3 |
| CO3 | Make use of organic polymerization processes | PO-1,5 | 3 |
| CO4 | Understand the applications of organic boranes. | PO-2,4,5 | 3 |
| CO5 | Ability to synthesize organic molecules for general health issues | PO-2,3 | 3 |

Syllabus:

Formation of Carbon-Carbon single bounds: alkylations via enolate the enamine and related reactions, umplong (dipole inversion) reactions – the aldol reaction – applications of organo palladium, organo nickel and organo copper reagents ,applications of α-thiocarbonions, selenocarbonions and sulphur ylides, synthetic applications of carbenes and carbenoids.Formation of carbon-carbon double bonds: Elimination reactions Pyrolytic, syneliminations, sulphoxide-sulphonate rearrangement the witting reaction-alkenes from arylsulphonyl hydrazones, claisen rearrangement of allyl vinylethers.Organoboranes: Preparation of Organobornaes viz hydroboration with $BH_3$-THF, dicyclohexyl borane, disiamyl borane, thexyl borane, 9-BBN and diisopino camphenyl borane, functional group transformations of Organo boranes-Oxidation, protonolysis and rearrangements. Formation of carbon – carbon bonds viz organo boranes carbonylation, the cyanoborate process and reaction of alkenyl boranes and trialkenyl borates.Methods of polymerization (a) addition polymerization (b) Condensation polymerization (c) Radical polymerizations (two examples of each method) Reactions of unactivated carbon-hydrogen bonds: The HoffmannLieffier- Freytag reaction-the Barton reaction-Photolysis of organic hypothalites.

**List of Experiments**

| **S. No** | **Name of the Experiment** |
|---|---|
| 1 | Synthesis of P- Bromo acetanilide from aniline |
| 2 | Preparation of Aspirin from Methyl salicylate |
| 3 | Preparation of 2,4- Di Nitro Phenol from Chlorobenzene |
| 4 | Synthesis of Anthraquinone from Phthalic anhydride |
| 5 | Synthesis of P- Nitro Aniline from Acetanilide |
| 6 | Synthesis of Benzylic acid from Benzoin |
| 7 | Synthesis of 1,3,5- Tribromo Benzene from Aniline |
| 8 | Synthesis of M- Nitro Aniline from Nitro Benzene |
| 9 | Synthesis of Beta- Naphthol from Naphthalene |
| 10 | Synthesis of Coumarin from Phenol |

**TEXT BOOKS:**

1) Advanced Organic Chemistry-Reactions, Mechanism and Structure by Jerry March, John Wiley.
2) Advanced Organic Chemistry by F.A. Carey and R.J Sundberg, Plenum.
3) Structure and Mechanism in Organic Chemistry by C.K.Inglod, Cornell University Press.
4) Organic Chemistry by R.T Morrison and R.N. Boyd, Prentice - Hall.
5) Principles of Organic Synthesis by R.O.C Norman and J. M. Coxon, Blackie Academic
6) Stereochemistry by P.S.Kalsi, Wiley Eastern.
7) Text book of Organic Chemistry by M.C. Murry
8) Organic Chemistry Vol. I (Sixth Edn.) and Vol. II (Fifth Ed.,) by IL Finar ELBS. Chemistry (fifth Edn.,) by Morrison and Boyd, PHI, India.
9) Organic Chemistry (fifth edition) by Francis A. CareyTata Mc Graw Hill publishing company Limited, New Delhi.
10) Reaction Mechanism in Organic Chemistry by Mukherjee Sirigh, N Terniitarr, Indiar
11) Text book of Practical Organic Chemistry by Vogel

## 19CY5311-NATURAL PRODUCTS AND BIOMOLECULES

**L-T-P-S: 4-0-6-0** **Credits: 7** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Illustrate the synthesis and significance of microbial metabolites | PO-1,4 | 3 |
| CO2 | Outline the origin & chemical nature of Terpenes | PO-1,3,5 | 3 |
| CO3 | Outline the origin & chemistry of Alkaloids | PO-1,2,3 | 3 |
| CO4 | Demonstrate properties & synthetic methods of peptides | PO-4,5 | 3 |
| CO5 | Ability to isolate and estimate the bioactive compounds from various plant extracts | PO-2,3 | 3 |

Syllabus:

Structure, isolation, stereochemistry and synthesis of the following class of natural products from plant, animal and microbial sources: Acetogenins and shikimates: Microbial metabolites: Pencillin G, Cephalosphorin-Ö and streptomycin. Terpenoids: Forskolin, taxol and azadirachtin. Biogenesis and biological properties of the Pencillin G, Cephalosphorin-Ö and streptomycin, Terpenoids: Forskolin, taxol and azadirachtin.Structure, isolation, stereochemistry and synthesis of the following class of natural products from plant, animal and microbial sources: Alkaloids: Morphine, reserpine and vincristine Biopolymers: Peptides: α-Aminoacids.Synthesis of peptides by Merrifield solid phase synthesis. Chemistry of oxytocin and dolastain-10.

**List of Experiments**

| S. No | Name of the Experiment |
|---|---|
| 1 | Estimation of Hydroxyl group by acetylation or phthalation method |

| | |
|---|---|
| 2 | Estimation of phenol by bromination method |
| 3 | Estimation of aniline by Bromination method |
| 4 | Estimation of Carbonyl Groups by Hydrogen formation method |
| 5 | Estimation of sugars by using Fehling's method |
| 6 | Estimation of Vitamin-C in lime Juice |
| 7 | Isolation of Caffeine from tea |
| 8 | Isolation of Lycopene from Tomatoes |
| 9 | Isolation of Lactose from Milk |
| 10 | Isolation of Citric Acid from Lemon |

**TEXT BOOKS:**


1. Organic Chemistry by I.L. Finar Vol. I and II, 9th Edition, Pearson, 2009.
2) Medicinal Chemistry by Graham L. Patrick, Oxford University Press, 2005.
3) Text book of Practical Organic Chemistry by Vogel


**19CY5312 -ORGANIC SPECTROSCOPY**

**L-T-P-S: 4-0-0-0** **Credits: 4** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Evaluate theoretical and experimental methods of analysis using IR spectroscopy | PO-2,3 | 3 |
| CO2 | Evaluate theoretical and experimental methods of analysis using UV spectroscopy | PO-1,4 | 3 |
| CO3 | Understand proton NMR & 13C NMR and mass spectrometry methods of analysis | PO-3,5 | 3 |
| CO4 | Able to apply spectroscopic methods (UV, IR, $^{1}$H-NMR,$^{13}$C-NMR & mass spectrometry) in organic structure elucidation. | PO-1,4,5 | 3 |

Syllabus:

Various electronic transitions - Effect of solvent on electronic transitions - Ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes and conjugated polyenes. Fieser-Woodward rules for conjugated dienes and carbonyl compounds - Ultraviolet spectra of

aromatic and heterocyclic compounds - Steric effect in biphenyls. Characteristic vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, phenols and amines - Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides, acids, anhydrides, lactones, lactams and conjugated carbonyl compounds). Effect of hydrogen bonding and solvent effect on vibrational frequencies, overtones, combination bands and Fermi resonance.Mass Spectrometry Introduction - Ion production - Types of ionization; EI, CI, FD, and FAB - Factors affecting fragmentation - Ion analysis - Ion abundance. Mass spectral fragmentation of organic compounds - Common functional groups - Molecular-ion peak - Metastable peak - Mc. Lafferty rearrangement. Nitrogen rule - Isotope labeling - High resolution mass spectrometry. Examples of mass spectral fragmentation of organic compounds with respect to their structure determination.Nuclear spin - Nuclear resonance - Saturation, shielding of magnetic nuclei - Chemical shifts and its measurements - Factors influencing chemical shift - Deshielding - Spin-spin interactions - Factors influencing coupling constant 'J' – Classification (ABX, AMX, ABC, A2B2etc.) - Spin decoupling - Basic ideas about instrument - FT-NMR - Advantages of FT-NMR. Shielding mechanism - Mechanism of measurement - Chemical shift values and correlation for protons bonded to carbon (aliphatic, olefinic, aldehydic and aromatic) and other nuclei (alcohols, phenols, en ols, carboxylic acids, amines and amides) - Chemical exchange - Effect of deuteration - Complex spin-spin interaction between two, three, four and five nuclei (First order spectra) - Virtual coupling. Stereochemistry - Hindered rotation - Karplus curve variation of coupling constant with dihedral angle. Simplification of complex spectra: nuclear magnetic double resonance - Contact shift reagents - Nuclear overhauser effect (NOE). $^{13}$C-NMR Spectroscopy: General considerations - Chemical shift (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carbonyl carbon) - Coupling constants.

**TEXT BOOKS:**


1) Fundamentals of molecular Spectroscopy by 3rd ed., TMH, New Delhi, 1983.
2) Spectroscopy by B.P. Straughan and S.Walker, Vol.3, Chapman Hall, London, 1976.
3) Introduction to Molecular Spectroscopy by G.M. Barrow, McGraw Hill, New York, 1964.
4) Introduction to Photoelectron Spectroscopy by P.K.Ghosh, John Wiley New York, 1989.
5) Spectroscopic Identification of Organic Compounds by P.M. Silverstein, F. X. Wester, 6th ed., Wiley 1998.
6) Organic Spectroscopy by W. Kemp, 3rd Ed., MacMillon, 1994.
7) Applications of Absorption Spectroscopy of Organic Compounds by J.R. Dyer, Prentice Hall, 1965.


## 19CY5401-INSTRUMENTAL METHODS OF ANALYSIS-II

**L-T-P-S: 4-0-6-0** **Credits: 7** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Discuss and understand the principles and instrumentation involved in the Flame photometry. Atomic Absorption Spectrometer, Inductively coupled plasma spectrometer and Arc and Spark spectrographic Direct analysis. | PO-2, 5 | 3 |
| CO2 | Discuss and apply the various principles and methodology in TGA, DTA and DSC | PO-1,3 | 3 |

| | | | |
|---|---|---|---|
| CO3 | Discuss and apply the principles and methodology involved in Voltametry, polarography, Anode stripping voltametry and Coulometry. | PO-1,3,5 | 3 |
| CO4 | Discuss the principles and methodology in assaying the analytes using Ion Selective Electrodes and Radio chemical methods | PO-2,3,5 | 3 |
| CO5 | Ability to analyse chemicals by Instrumental methods | PO-3,5 | 3 |

Syllabus:

**Electro analytical Methods of Analysis:** Polarographic principles, Instrumentation (different types of microelectrode such as dropping mercury electrode, the static drop mercury electrode, rotating disc and ring disc electrode, cell for polarography, reference and counter electrode and circuit diagram), polarogram and polarographic currents, charging or capacitive current, role of supporting electrolyte, factors affecting on polarographic wave, Ilkovic Equation, advantages and disadvantages of DME, polarographic maxima and maxima suppresors, interference due to dissolved oxygen, Applications (qualitative analysis, quantitative analysis by calibration curve and standard addition methods), specific examples of analysis–analysis of Cu, Cd, Zn, Pb, etc. from tap water and alloys., problems. **Pulse Polarography:** different types of excitation signals in pulse polarography, Differential pulse polarography, square wave polarography, Stripping method. Voltametry with ultra microelectrode, Applications of these techniques Cu and Zn from tap water by differential pulse polarography and by square wave polarography, Vitamin-C by differential pulse polarography **Anode stripping voltametry:** principle, instrumentation, Hanging mercury drop electrode, application in the analysis of Pb and Cd in environmental samples, principle of cathode stripping voltammetry.**Principle of cyclic Voltammetry**, cyclic voltamogram of $K_3[Fe(CN)_6]$, and parathion, criteria of reversibility of electrochemical reactions, quasireversible and irreversible processes. **Coulometric analysis:** principles of coulometric analysis with constant current, coulometric analysis with controlled potential, applications of coulometric methods for the analysis of cations-As (III), Fe (II) and $I^-$ and $S^{2-}$ by using $I_2$ liberations and $Ce^{4+}$ liberation in solutions **Spectro-Analytical Methods Of Analysis: Flame photometry:** theory, instrumentation, combustion flames, detectors, and analysis of Na, K, Ca, Mg etc. **Atomic Absorption Spectrometer:** theory, instrumentation, flame and non-flame techniques, resonance line sources, hollow cathode lamp, instrumentation, chemical and spectral interferences, applications with special reference to analysis of trace metals in oils, alloys and toxic metals in drinking water and effluents.**Inductively coupled plasma spectrometer (ICP-AES, ICP-MS):** principles, instrumentation, plasma, AES detectors, quadrupole mass spectrometers, difference between the two detectors, analysis methods for liquids and solids, applications in the analysis of trace and toxic metals in water, geological and industrial samples **Thermal methods of Analysis:** Thermo gravimetry-theory, instrumentation, applications with special reference to $CuSO_4.5H_2O$, $CaC_2O_4.2H_2O$, $CaCO_3$, $(COOH)_2.2H_2O$ Differential thermal analysis-principle, instrumentation, difference between TG and DTA-applications with special reference to the clays and minerals, coals (fuels)**.** Differential scanning calorimetry-principle, instrumentation, applications to inorganic materials like chlorates and per chlorates, ammonium nitrate, organic compounds and Drugs**.Radio chemical methods of analysis:** detection and measurement of radioactivity, introduction to radioactive tracers, applications of tracer technique, isotope dilution analysis-applications, activation analysis – application, advantages and disadvantages, radio carbon dating technique

List of Experiments:

**Voltammetry**

1. Fabrication of carbon paste electrode.
2. Determination of peak potential of Pb, Cd and Zn using differential pulse voltammetry at carbon paste electrode.
3. Determination of amount Pb present in unknown sample using square wave voltammetry.
4. Determination of amount Cd present in unknown sample using square wave voltammetry.
5. Determination of amount Zn present in unknown sample using square wave voltammetry.

**Spectrophotometry**

1. Spectrophotometric determination of Fe (III) using KSCN.
2. Spectrophotometric determination of phosphate.
3. Spectrophotometric determination of Cr (VI).
4. Spectrophotometric determination of Nitrite.
5. Determination of pKa value of an indicator by spectrophotometry.

**pH-metry**

1. Determination of dissociation constant (pKa) of acetic acid using pH-metry.
2. Determination of dissociation constant (pKa) of acetic acid using point wise calculation
3. Determination of carbonate and bicarbonate in the given mixture by pH-metry.
4. Determination of isoelectric point of amino acids.
5. Determination of ionization constant of amino acids using Irving Rosotti method.

**Conductometry**

1. Determination of halides ($Cl^-$, $I^-$ etc.) using conductometric method.
2. Determination of the degree of ionization and ionization constant of weak electrolytes.
3. Determination of solubility of sparingly soluble salts by conductometric method.
4. Estimation of Aspirin by conductometry.

**Chromatography**

1. Separation of amino acids by TLC.
2. Determination of aspirin by HPLC.
3. Separation of pigments by paper chromatography.
4. Separation of cations and their quantification by ion exchange chromatography.

**Flame photometry**

Determination of Na, K and Li by Flame photometry.

**TEXT BOOKS:**


1) Instrumental methods of analysis by H.H Willard, Meritt Jr. and J.A Dean
2) Principles of instrumental analysis by Skoog and West
3) Vogels Textbook of Quantitative Inorganic analysis by J. Basset, R.C Denney, G.H Jefferey and J.Madhan
4) Instrumental methods of analysis by B.K Sarma, Goel Publishing House, Meerut

5) Instrumental methods of Analysis by Chatwal and Anand
6) Instrumental methods of Analysis by Ewing

**REFERENCE BOOK:**

1) Thermal Analysis by W.Wendtlandt, John Wiley Sons, New York

## 19CY5402-ADVANCED APPLIED ANALYSIS

**L-T-P-S: 3-0-0-0 Credits: 3 Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | To discuss the concepts of analysis of ferrous, non-ferrous metals and allied Fe compounds | PO-2,5 | 3 |
| CO2 | To understand analysis of soil, fertilizer and fuel for applied purposes. | PO-3,4 | 3 |
| CO3 | To discuss different methods involved in analysis of different gaseous components in air. | PO-1,3 | 3 |
| CO4 | To determine moisture content in drugs and other samples. | PO-2,3,5 | 3 |
| CO5 | Explain the various principles involved in the analysis of Organic Functional Groups | PO-2,4 | 3 |

Syllabus:

**Analysis of raw materials:** Analysis of non-ferrous alloys: Brass – Analysis of the constituents – Cu, Zn, Sn, Pb and Fe. Bronze -Analysis of the constituents -Cu, Sn, Zn, Pb and Fe. Solder - Analysis of the constituents – Sn, Pb and Sb. Analysis of Ferro alloys : Ferro silicon - Analysis of the constituents – Si, C, P,S Ferro vanadium - Analysis of the constituents – V, C, P, S. Si, Al. Ferro manganese - Analysis of the constituents – Mn, S, C, P, Si Silico manganese - Analysis of the constituents –Mn, S, C, P, Si Ferro chromium - Analysis of the constituents – Cr, C, Si.**Analysis of Soil, Fertilizer and Fuel:** Analysis of soils: sampling, determination of moisture, total N, P, Si, lime, humus nitrogen, alkali salts, soil absorption ratio. Analysis of fertilizers: ammonical fertilizers, Phosphate fertilizers, Nitrate fertilizers. Analysis of fuels: solid fuels-coal, proximate analysis, ultimate analysis, heating value, grading of coal based on Ultimate Heat Value (UHV).***ASSESSMENT OF AIR QUALITY:*** *Composition of Pure Air, Classification of Air Pollutants, Toxic Elements Present in Dust and their Sources – Collection of Air Samples.Sources, Effects, Control of Pollution and Chemical Analysis for the following. Primary Pollutants:*Carbon compounds - Carbon monoxide(CO) and Carbon dioxide($CO_2$ ). Sulphur compounds- sulphur dioxide ($SO_2$), Sulphur trioxide ($SO_3$) and Hydrogen Sulphide ($H_2S$). Nitrogen compounds - nitric oxide (NO), and nitrogen dioxide ($NO_2$), Hydrocarbons - Aliphatic hydrocarbons and polycyclic aromatic hydrocarbons (PAH). Particulate matter - Repairable and Suspended particulate matter, Inorganic and Organic particulates. Secondary pollutants - ozone ($O_3$), peroxy acetyl nitrate (PAN), peroxy benzyl nitrate (PBN), Standards for ambient air quality. **Kinetic Methods of Analysis & Non aqueous Titrimetry:** Kinetic methods of analysis: introduction, slow reactions, catalyzed reactions, methods of determination of catalyst concentration, extrapolation method for the determination of catalyst, variable time method, fixed time method, examples for the determination of toxic metals and anions using some typical kinetic reactions.**Non aqueous titrimetry:** Classification of solvents and titrations for non

aqueous titrimetry- Types of reactions – Indicators. Determination of acids Determination of bases Karl-Fisher reagent for the determination of moisture content in drugs and other samples.

List of Experiments:

**1. Complexometric titrations**

(i) Analysis of zinc in zinc ore by using EDTA

(ii) Analysis of nickel by EDTA

(iii) Analysis of limestone or dolomite

**2. Analysis of oils, fats and soaps**

(i) Analysis of oil for the determination of saponification value, acid value and iodine value

(ii) Analysis of soaps for moisture content and total alkali

**3. Analysis of coal**

(i) moisture content

(ii) volatile matter

**(iii)** fixed carbon ash content

***TEXT BOOKS:***


1) Chemical analysis by H.A Laitinan, Mc Graw Hill Book Co
2) Standard methods of Chemical Analysis by Welcher
3) Technical Methods of Analysis by Griffin, Mc Graw Hill
4) Commercial Methods of Analysis by Foster Dee Sneel and Frank M. Griffin, Mc Graw Hill Book Co.
5) Environmental Chemistry by Anil Kumar De, Wiley Eastern Ltd.
6) Environmental Analysis by S.M Khopkar (IIT Bombay)
7) Environmental Air Analysis by Trivedi and Kudesia, Akashdeep Pub.


## 19CY5407-ORGANIC SYNTHESIS –II

**L-T-P-S: 4-0-6-0** **Credits: 7** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Explain the properties of Oxidising agents and reducing agents | PO-1,4 | 3 |
| CO2 | Illustrate reaction mechanisms for some Organosilane related compounds | PO-2,3 | 3 |
| CO3 | Explain theory and principles involved in Disconnection approach and principals of Phase transfer catalysis | PO-1,3 | 3 |
| CO4 | Explain about the Retrosynthesis and applied to various cyclic organic molecules | PO-1,5 | 3 |
| CO5 | To carryout multistep synthesis of organic molecules | PO-2,4 | 3 |

Syllabus:

Organo silanes, Synthetic applications of trimethylsilyl chloride dimethyl-t-butylsilyl chloride, trimetthylsilyl cyanide, trimethylsilyl iodide and trimethylsilyl triflate, synthetic applications of silyl carbanion and B-silyl carbonium ions.Oxidations of hydrocarbons, alkenes, alcohols,

aldehydes and ketones. Oxidative coupling reactions by the use of Pb $(OAC)_4$, NBs, $CRO_3$, $SeO_2$, $NinO_2$ Dc- alkoxyluphonium yields, $KMnO_4$, $OsO_4$, peracids and Ti (III) nitrate. Catalytic hydrogenation (homogeneous and heterogeneous), reduction by dissolving metals. Reduction by hydride transfer -reagents, reduction with hydrazine and diamide, selectivity in reduction of nitroso and nitro compounds, reductive cleavage.Design of Organic Synthesis: Retrosynthesis the disconnection approach-basic principles convergent and linear synthesis.Phase transfer catalysis-Principle and applications.

**Experiments:**

| S. No | Name of the Experiment |
|---|---|
| 1 | Synthesis of 1- Bromo-2- Bromo Methyl Naphthalene |
| 2 | Synthesis of Sulphanilide from Acetanilide |
| 3 | Synthesis of Hippuric acid |
| 4 | Synthesis of 7- Hydroxy- 4- Methyl Coumarin |
| 5 | Synthesis of 1,3,5- Tri Bromo Benzene |
| 6 | Synthesis of 2,4,6- Tri bromo Aniline |
| 7 | Synthesis of Anthracene- Maleic anhydride adduct |
| 8 | Synthesis of Meta dinitro Benzene |
| 9 | Synthesis of Meta Nitro Aniline |
| 10 | Synthesis of Azalactone |

**TEXTBOOKS:**


1) Some Modern Methods of Organic Synthesis by W. Carothers, Third Edition, Cambridge University Press, Cambridge, 1988.
2) Organic Synthesis: The disconnection approach by S. Warrant John Wiley & sons, New York, 1984.
3) Modern Synthetic Reactions by Herbet O. Horase, Second Edition, W.A. Benzamine Inc. Menio Park, California, 1972.
4) Organic Synthesis viz Boranes by Herbet C. Brown Gray, W. Kramer Alan B. Levy and M. Mark Midland John Wiely &. Sons, New York, 1975.
5) Textbook of Practical Organic Chemistry by Vogel

6) Textbook of Practical Organic Chemistry by Mann & Sunders

## 19CY5408-ADVANCED HETEROCYCLIC CHEMISTRY

**L-T-P-S: 4-0-6-0** **Credits: 7** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | To classify, synthesis and reactivity of simple heterocyclic aromatic and non-aromatic compounds as electron deficient or electron rich and explain their reactivity based on these properties | PO-1,2 | 3 |
| CO2 | Apply the aromaticity, reactivity and synthesis of Five, six membered heterocyclic compounds with two hetero atoms | PO-1,2 | 3 |
| CO3 | Apply the aromaticity, reactivity and synthesis of heterocyclic compounds with more than hetero atoms | PO-2,3 | 3 |
| CO4 | Apply the synthesis, structure, reactivity and stability of larger ring heterocyclics | PO-1,3,4 | 3 |
| CO5 | Ability to synthesize heterocyclic compounds | PO-2,4 | 3 |

Syllabus:

Nomenclature (Hantzsch Widman System), spectral characteristics, reactivity and aromaticity of monocyclic, fused and bridged heterocycles. Nonaromatic heterocycles. Different types of strains, interactions and conformational aspects on nonaromatic heterocycles. Synthesis, reactivity and importance of the following ring systems. Azirines, Oxaranes, Thiiranes, Diazirenes, Diaziridines, Azetidines. Five and six-membered heterocycles with two hetero atoms: Synthesis, reactivity, aromatic character and importance of the following heterocycles: Pyrazole, Imidazole, Oxazole, Thiazole, Pyrimidine, Pyrazine, Oxazine, and Thiazine.Heterocycles with more than two hetero atoms: Synthesis, reactivity, aromatic character and importance of the following heterocycles: Triazoles, Oxadiazoles, Thiadiazoles, Triazines. Larger ring and other heterocycles: Synthesis and reactivity of Azepines, Oxepines and Thiepines.Synthesis and rearrangement of Diazepines. Synthesis of Benzoazepines, Benzodiazepines, Benzooxepines, Benzothiepines, Azocines, and Azonines. Banzanellated azoles and dipolar structures: Banzanellated azoles: Synthesis and reactivity of Benzimidazoles, Benzoxazoles and Benzothiazoles. Heterocyles with Ring-Junction nitrogen: Synthesis and reactivity of Quinolizines, Indolizines and Imidazopyridines. Heterocycles with dipolar structures.Betaines: Formation, aromaticity and reactivity of pyridine-N-oxides and pyridinium imides. Mesoionic heterocycles: Synthesis and aromaticity of sydnones and 1,3- dipolar addition reaction of mesoionic heterocycles.

Experiments:

| S. No | Name of the Experiment |
|---|---|
| 1 | Synthesis of Thiepine |
| 2 | Synthesis of benzophenone |

| | |
|---|---|
| 3 | Synthesis of diazotized compounds (Triazoles) |
| 4 | Synthesis of1,2,4- Triazole |
| 5 | Synthesis of Isoxazole |
| 6 | Synthesis of Ergotamine (Indole based alkaloid) |
| 7 | Synthesis of Cinchonine |
| 8 | Synthesis of Quinine |
| 9 | Synthesis of Prima Quinine |
| 10 | Synthesis of Acetazolamide |

**TEXT BOOKS:**


1) Heterocyclic Chemistry by T.Gilchrist
2) An introduction to the Chemistry of heterocyclic compounds by R.M.Acheson
3) Heterocyclic Chemistry by J.A.Joule&K.Mills
4) Principles of Modern Heterocyclie Chemistry by A.Paquette
5) Heterocyclic Chemistry by J,A.Joule& Smith
6) Handbook of Heterocyclic Chemistry by A.R.Katritzky
7) Aromatic character and aromaticity by G.M.Badger
8) Non-benzenoid aromatic compounds by D.Ginsberg
9) Nonbenzenoid compounds by Lloy


## PROFESSIONAL ELECTIVES

## 19CY5304-SEPARATION TECHNIQUES-I

**L-T-P-S: 3-0-0-0** **Credits: 3** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Discuss principle of chromatography, different techniques and its modification to adsorption chromatography for analytical applications | PO-1,3 | 3 |
| CO2 | Apply gas chromatography phenomenon for the analysis of gases, petroleum products | PO-1,2,3 | 3 |
| CO3 | Understand the basic principle of LC-MS | PO-1,2,3 | 3 |
| CO4 | Employ GC-MS and HPLC concepts in the application of | PO-1,3,4,5 | 3 |

| | | | |
|---|---|---|---|
| | pharmaceutical drug analysis | | |

Syllabus:

**Chromatography:** classification of different chromatographic methods, methods of development-Elution development, Gradient elution development, displacement development, and frontal analysis. Principles of chromatography, different migration, adsorption phenomena, partition, adsorption coefficient, retardation factor, retention time and volume, column capacity, temperature effects, partition isotherm. Dynamics of chromatography-efficiency of chromatographic column, zone spreading, High Equivalent Theoretical Plate (HETP), Van Deempter equation, resolution, choice of column, length and flow velocity, qualitative and quantitative analysis. **Column chromatography (adsorption chromatography):** principles, general aspects, adsorption isotherms, chromatographic media, nature of forces between adsorbent and solutes, eluents (mobile phase), column chromatography without detectors and liquid chromatography with detectors and applications.**Gel Exclusion chromatography or Gel filtration chromatography:** principles, properties of xerogels, apparatus and detectors, resolution of gel type, applications to organic compounds. **Capillary Electrophoresis:** Principle, Details of the Instrument, Applications to Inorganic and Organic compounds. **Gas chromatography:** Theory, Instrument description of equipment and different parts, columns (packed and capillary columns), detector specifications-thermal conductivity detector, flame ionization detector, electron capture detector, nitrogen-phosphorus detector, photo ionization detector, programmed temperature gas chromatography; applications in the analysis of gases, petroleum products etc., other detectors used their Principles and Applications.**Inorganic molecular sieves:** structure of zeolites, crystals, types of sieves, application in the separation of gases including hydrocarbons, ion exclusion-principles and applications, Counter current chromatography-principles and application, Affinity chromatography-principles and applications. **GC-MS-Introduction:** Instrumentation – GC – MS interface – Mass spectrometer (MS) Instrument operation, processing GC – MS data – ion chromatogram Library searching – Quantitative measurement-sample preparation Selected ion monitoring – Application of GC-MS for Trace constituents, Drugs analysis, Environmental analysis and others. **Liquid-liquid partition chromatography:** principle, supports, partitioning liquids, eluents, reverse phase chromatography, apparatus, applications. **High performance liquid chromatography:** Theory, Instrument description of the different parts of the equipment, columns, detectors-UV detector, refractometric detector, Fluorescence detector, Diode Array detector, applications in the separation of organic compounds, names of other detectors used their Principles and Applications.**LC-MS:** Introduction-Instrumentation-liquid chromatograph-Mass spectrometer Interface Instrumental details-Processing LC-MS data-ion chromatograms-Library searching-Quantitative measurements. Sample preparation – selected ion monitoring. Application of LC-MS for Drug analysis, Environmental samples and others.

**TEXT BOOKS:**


1. Techniques and practice of Chromatography by R.P.W Scott, Marel Dekker Inc., New York
2. Separation methods by M.N. Sastri, Himalaya Publishing Company, Mumbai


**REFERENCE BOOKS:**


1. Chromatography by E. Helfman, Van Nostrand and Reinhold, New York

2. Chromatography by E. Lederer and M. Lederer, Elsevier, Amsterdam.
3. Chemical separation methods by John A Dean, Von Nostrand Reinhold, New York
4. Techniques and practice of Chromatography by R.P.W Scott, Marel Dekker Inc., New York
5. Basic Gas Chromatography by H.M Mc Nair and J. M. Miller, John Wiley, New York
6. Analytical Gas Chromatography by W. Jeumings, Academic Press, New York
7. Practice of HPLC by H. Eugelhardt (ed), Springer Verrag, Berrin
8.

## 19CY5305-APPLICATIONS OF CHEMICAL SPECTROSCOPY

**L-T-P-S: 3-0-0-0 Credits: 3 Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Discuss the fundamental principles of basic characterization techniques | PO-1,4 | 3 |
| CO2 | Apply NMR techniques in the elucidation of complex molecules | PO-1,2 | 3 |
| CO3 | Determination of elemental or isotopic signature of sample | PO-2,3 | 3 |
| CO4 | Identification of chemical structure of a molecule by spectroscopy | PO-3,4,5 | 3 |

Syllabus:

Infrared Spectroscopy: Fourier Transform infrared spectroscopy: Applications. Ultraviolet and visible spectroscopy: Applications of UV-Visible spectroscopy, Nuclear Magnetic Resonance Spectroscopy:Applications of AB, AX, ABC, AMX Systems; double resonance, Lanthanide shift reagents; Carbon-13 NMR spectroscopy; COSY, NOE, FT NMR, 2D NMR and CIDNP.Mass Spectrometry: Fragmentation: McLafferty rearrangement. Particle bombardment methods, PD, SIMS, FAB, Gas chromatography-mass spectrometry, MS data system. Combined Applications: UV, IR, NMR and Mass in the elucidation of molecular structure.

**TEXT BOOKS:**

1) Introduction to Spectroscopy by Donald L. Pavia and Gary M Lanyman, 3rd Edition, Thompson Publishers, 2008.
2) Spectroscopy of Organic Compounds by P.S. Kalsi, 6th Edition, New Age International Publishers, 2004.
3) Elementary Organic Spectroscopy-Principles and Applications by Y. R. Sharma, 5th Edition, S. Chand Publishers, 2007.

## 19CY5306- BIO ANALYTICAL CHEMISTRY

**L-T-P-S: 3-0-0-0 Credits: 3 Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Understand the basic principles of bioanalysis | PO-2,4 | 3 |
| CO2 | Explain the basic concept of Radiochemical Manometric and | PO-1,3 | 3 |

| | | | |
|---|---|---|---|
| | Calorimetric | | |
| CO3 | Apply electrophoretic method in bioassay | PO-2,3 | 3 |
| CO4 | Explain and apply biosensors in biomolecule analysis | PO-2,3,5 | 3 |

Syllabus:

Relevance of BioAssaying and Biochemical Analysis; Spectroscopic methods and fluorimetric methods; Quantitation of Enzymes and Optical Methods of Detection of Enzymes; Electroanalytical Methods of Enzyme Detection.Radiochemical, Manometric, Calorimetric and Other Miscellaneous Methods; Immobilization Methods; Methods; Mass Spectrometry of Biomolecules, Matrix-assisted laser desorption/ionization (MALDI).Chromatography of macromolecular biomolecules; Mass Transfer Methods; Centrifugation and Sedimentation Methods; Electrophoretic Methods.Electrochemical Sensors and BioSensors in Bioanalysis; Immuno assaying.

**TEXT BOOKS:**


1) Bio Analytical Chemistry by Susan R. Mikkelsen and Eduardo Cortón, John Wiley & Sons Inc, 2004
2) Bio Analytical Chemistry by Andreas Manz and Nicole Pamme, Imperial College Press, 2012


## 19CY5307-ENVIRONMENTAL CHEMISTRY

**L-T-P-S: 3-0-0-0 Credits: 3 Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Understand green house effect concept | PO-2,5 | 3 |
| CO2 | Employ various sampling techniques for air sampling | PO-2,3,5 | 3 |
| CO3 | Understand various pollution monitoring techniques | PO-1,3,4 | 3 |
| CO4 | Explain environmental Impact Assessment process | PO-1,2,5 | 3 |

Syllabus:

Chemistry of Atmosphere: Composition and structure of atmosphere, Greenhouse effect, Ozone depletion, Photochemical smog, Air sampling techniques, Sources, effects and monitoring of air pollutants by Instrumental methods.Control of air pollution, Water Pollution, Different types of water pollutants, Sources, characteristics and effects of water pollutants, Monitoring of Water Pollutants. Treatment of Municipal Waste Water, Treatment of Industrial Waste Water, Environmental Impact Assessment process in India.Basic principles of Green Chemistry

**TEXT BOOKS:**


1) Fundamental Concepts of Environmental Chemistry by G.S. Sodhi, 2nd Edition, Narosa publishing House, 2005
2) New Trends in Green Chemistry by V.K. Ahluwalia, M. Kidwai, Anamaya publishers, 2004.
3) Waste Water Treatment by M.N. Rao and A.K. Datta, 2nd Edition, Oxford Publications, 2007.


## 19CY5308-SURFACE ANALYTICAL TECHNIQUES

**L-T-P-S: 3-0-0-0 Credits: 3 Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Understand the basic principles of Electron Spectroscopy for Chemical Analysis | PO-1,2 | 3 |
| CO2 | Employ Surface enhanced Raman Spectroscopy (SERS) in mapping and imaging | PO-2,3,6 | 3 |
| CO3 | Describe Electron Energy Loss Spectroscopy | PO-1,2 | 3 |
| CO4 | Apply Low Energy Ion Scattering Spectroscopy for Surface structural analysis | PO-1, 4,5 | 3 |

Syllabus:

Electron Spectroscopy for Chemical Analysis (ESCA): Principles, Instrumentation, and Analytical Applications. Auger electron spectroscopy: Principles, Instrumentation, Applications. Secondary ion mass spectrometry (SIMS): Principles, Instrumentation, Applications. Surface enhanced Raman Spectroscopy (SERS): Principles, Instrumentation, Nanoparticulate SERS substrates, Surface enhanced resonance Raman scattering (SERRS), SERRS of Ag and Au metal colloids, Thin solid films, Langmuir-Blodgett Monolayers, SERRS, Mapping and imaging, Applications.Electron Energy Loss Spectroscopy (EELS): Principles, Instrumentation, Applications. Electron Microprobe analysis: Principles, Instrumentation, Analysis of semiconductors and crystalline materials, Applications.Low Energy Ion Scattering Spectroscopy: Principle, Instrumentation, Surface structural analysis

**TEXT BOOKS:**


1) Surface Analysis Methods in Materials Science by D J O'Connor, Brett A Sexton, Roger S C Smart (Eds), 2nd Edition, Springer, 2010.
2) Surface Analysis: The Principal Techniques by John C Vikerman, Ian Gilmore (Eds.), 2nd Edition, Wiley, 2009.
3) An Introduction to Surface Analysis by John F Watts and John Wolstenholme, 2nd Edition, Wiley VCH, 2011.


## 19CY5309-ANALYSIS OF FOOD AND DRUGS

**L-T-P-S: 3-0-0-0** **Credits: 3** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Understand the importance of food analysis | PO-1,2 | 3 |
| CO2 | Determination of various nutrients in food samples | PO-1, 3,6 | 3 |
| CO3 | Identification of food adulterants | PO-1,2,4 | 3 |
| CO4 | Employ quantitative methods of analysis in food samples | PO-1,5,6 | 3 |

Syllabus:

Importance of food analysis, Determination of approximate composition: Moisture, fat, protein, fiber, carbohydrate, etc.Quantitative analysis for food quality and safety - Determination of minerals, vitamins, anti-oxidants, toxins and preservatives. General idea of the properties of

drugs for their characterization and quantification.Quantitative methods of analysis - Gravimetric and volumetric analysis, potentiometry,Coulometry and amperometry titrations.Colorimetry, fluorimetry and polarimetry methods.

**TEXT BOOKS:**


1) Food Analysis, Food Science Texts Series by S Suzanne Nielsen, 3rd Edition, Springer, 2003.
2) Pharmaceutical Analysis by D Lee and M Webb, 1st Edition, Blackwell, 2003.
3)


## 19CY5313-PHOTO CHEMISTRY AND PERICYCLIC REACTIONS

**L-T-P-S: 3-0-0-0** **Credits: 3** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Ability to apply nucleophillic / electrophillic pathway to synthesize new organic entities | PO-2,3 | 3 |
| CO2 | Apply aromatic nucleophillic and free radical substitution mechanisms in new chain linkages | PO-1,3 | 3 |
| CO3 | Understand organic reaction mechanism in terms of pericyclic reactions at different conditions. | PO-3,4 | 3 |
| CO4 | Ability to explain pericyclic reactions involved in various organic rearrangement reactions. | PO-1,5,6 | 3 |

Syllabus:

Advanced organic named reactions with mechanisms: Baylis- Hillman reaction, Mitsunobu reaction, Pechmann condensation, Roush coupling, Shapiro reaction, Suzuki coupling.Fundamental concepts, Jablonski diagram, Energy transfer and characteristics of photo reactions. Photo reduction and photo oxidation, photo reactions of ketones and enones, Norrish Type I and II reactions. Photochemistry of alkenes, dienes and aromatic compounds, reactions of un-activated centres–Photolytic cycloadditions and photolytic rearrangements – Photosenstitisation –Photoadditions – Barton reaction – Parterno Buchi reaction.Concerted reactions – stereochemistry-orbital symmetry and concerted symmetry and correlation diagram –Frontier molecular orbital approach, Woodward and Hoffmann rules – Electrocyclic reactions – cycloaddition reactions.Sigmatropic rearrangements – selection rules and examples with simple molecules – 1,3 and 1,5 hydrogen shifts –Cope and Claisen rearrangements.

**TEXT BOOKS:**


1) Advanced Organic Chemistry: Reactions Mechanisms and Structure by Jerry March, Mc.Graw Hill and Kogakush.
2) Molecular reactions and Photochemistry by Charles Dupey and O. Chapman, Prentice Hall.
3) Pericyclic reactions by S.N. Mukharji, Mcmilan.
4) The modern structural theory in Organic Chemistry by L.N.Ferguson, Pretice Hall
5) Physical Organic Chemistry by Jack Hine, Mc. Graw Hill
6) Mechanisms and Theory in Organic Chemistry by T.H. Lowery and K.S. Rich gardson.


## 19CY5314-ORGANOMETALLIC CHEMISTRY

**L-T-P-S: 3-0-0-0** **Credits: 3** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | To explain the structure, synthesis, bonding, properties of the transition metal organo compounds. | PO-2,3 | 3 |
| CO2 | To describe the industrial significant processes through the application of organo metallic principles. | PO-1,2 | 3 |
| CO3 | To utilize the professional level skills in a chemical synthetic laboratories safety especially in the areas of air sensitive reagents. | PO-1,2,3 | 3 |
| CO4 | Demonstrate affective report writing, experimental design and data analysis. | PO-1,2,5 | 3 |

Syllabus:

Classification of Organometallic compounds, Metal alkyl-metal aryl complexes, Metal carbenes and metal carbines, Oxidative addition, reductive elimination, Migratory insertion reactions.Ligand substitution reactions and Fluxoinality in Organometallic compounds, Metal clusters.Capping rule, Mingos rule, Carbide clusters clusters having interstitial main group elements. Applications of organometallics as catalysts, C-C and C-N

**TEXT BOOKS:**


1) Advanced Organic Chemistry by F.A. Carey and R.J Sundberg, Plenum.
2) Structure and Mechanism in Organic Chemistry by C.K.Inglod, Cornell University Press.
3) Organic Chemistry by R.T Morrison and R.N. Boyd, Prentice - Hall.
4) Modern Organic Reactions by H.O. House, Benjamin.


## 19CY5315 -BIO ORGANIC CHEMISTRY

**L-T-P-S: 3-0-0-0** **Credits: 3** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Recognize the structure and function of Carbohydrates, Lipids, Amino acids, proteins, nucleotides and nucleic acids. | PO-1,2 | 3 |
| CO2 | Understand the reactions of the major catabolic and anabolic pathways of carbohydrates, Lipids, Amino acids, metabolism. | PO-1,3 | 3 |
| CO3 | Understand the signaling pathways of Lipids and Amino acids. | PO-2,3 | 3 |
| CO4 | Demonstrate the chemistry and kinetics of enzymes. | PO-1,5,6 | 3 |

Syllabus:

Amino acids, peptides and proteins Amino acids: acid base properties, isoelectric point, separation, resolution of racemic mixtures of amino acids, asymmetric synthesis Peptide bonds: peptide secondary structures and their stabilization, strategies for peptide synthesis, automated peptide synthesis.Primary, secondary, tertiary and quaternary structures, protein denaturation, natural β-amino acids and β-peptides; β-turn peptidomimetics, β-lactam based peptidomimetics.Enzymes Classification of enzymes, enzyme catalysis and kinetics, nucleophilic acid, base and metal-ion catalysis, the catalytic triad, mechanisms of carboxypeptidase A, serine

proteases and lysozyme, enzyme inhibition and drug design.Nucleosides and nucleotides, conformation of sugar-phosphate backbone, hydrogen bonding by bases, the double helix, A, B, and Z double helices.

**TEXTBOOKS:**


1. Organic Chemistry by P. Y. Bruice, 5th Ed., Pearson, 2014.
2) Introduction to Bioorganic Chemistry and Chemical Biology by D.V. Vranken and G.A. Weiss, 1st Ed., Garland Science, 2012.
3) Essentials of Carbohydrate Chemistry and Biochemistry by T. K. Lindhorst, 3rd Ed., Wiley 2007.
4) Peptides: Chemistry and Biology by N. Sewald and H.D Jakubke, 2nd Ed. Wiley, 2009.


## 19CY5316-GREEN CHEMISTRY

**L-T-P-S: 3-0-0-0** **Credits: 3** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Explain basic principles of green and sustainable chemistry. | PO-2,4 | 3 |
| CO2 | Understand the Stoichiometric calculations and relate them to green process metrics. | PO-1,3,4 | 3 |
| CO3 | Review the principles of catalysis, photochemistry and other interesting processes from the view point of Green Chemistry. | PO-3,6 | 3 |
| CO4 | Apply alternative solvent media and energy sources for chemical processes. | PO-2,3,5 | 3 |

Syllabus:

Principles of Green Chemistry, Concept of atom economy, Tools of Green Chemistry: Alternative feedstocks/starting materials, Reagents, Solvents, Product/target molecules, Catalysis and process analytical chemistry. Evaluation of chemical product or process for its effect on human health and environment.Evaluation of reaction types and methods to design safer chemicals. Evaluating the effects of Chemistry: Toxicity to humans, Toxicity to wildlife, Effects on local environment, Global environmental effects. Planning a green synthesis.Applications of Green Chemistry: Green synthesis of Ibuprofen, Design and application of surfactants for carbon dioxide for precision cleaning in manufacturing and service industries, Polyester regeneration technology, Microbes as environmentally benign synthetic catalysts, Environmentally safe marine antifoulant. Biodegradable polyaspartate polymers for inhibitors and dispersing agents, Recent applications in green chemistry.

**TEXT BOOKS:**


1) Introduction to Industrial Chemistry by Howard, W.L., Wiley-Interscience.
2) Industrial Organic Chemistry by Weissermel, K., and Arpe, H.J., 3rd ed.
3) Green Chemistry and Catalysis by Sheldon, R.A., Arends, I., and Hannefed, U., Wiley-VCH Verlag GmbH and Co.
4) Green Chemistry Frontiers in Benign Chemical Synthesis and Processes by Anastas, P., and Williamson, T. C., Oxford University Press.
5) New Trends in Green Chemistry by Ahluwalia, V. K., and Kidwai, M., Anamaya Publishers

## 19CY5317-FOOD CHEMISTRY

**L-T-P-S: 3-0-0-0** **Credits: 3** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Explain properties and reactions of carbohydrates, lipids and proteins during storage and processing of food. | PO-2,3 | 3 |
| CO2 | Identify the important sources of vitamins and minerals in food and their affect in quality aspects of food. | PO-1,4 | 3 |
| CO3 | Explain the importance of water for stability and quality of food. | PO-2,4 | 3 |
| CO4 | Understand the sources of important classes of undesirables in food and the HACCP term. | PO-1,2,5 | 3 |

Syllabus:

Source, functions of food – food groups – food guide – basic five food groups, usage of the food guide – food in relation to health – objectives of cooking. Water: Purification processes – Ion exchangers, reverse osmosis, activated charcoal treatment. Effect of cooking and heat processing of milk pasteurization, Preservation of milk. Deep freeze preservation, dairy products: cheese, butter, ghee and kova. Spray drying technique – milk powder, infant food preparation. Lactose intolerance Milk substitutes – vegetable milk.Amino acids – peptides – proteins, modification of food products through heat processing. Effect of cooking – steaming or cooking under pressure of legumes. Detoxication. Analysis of proteins principles in the determination of moisture content, ash content, nitrogen content – Kjeldahl's method. Separation of amino acids by paper chromatography, separation of proteins by electro phoresis.

Classification, structure and reactions of monosaccharides, glucose, fructose, structure of sucrose, maltose, lactose and starch. Artificial sweetening agents. Effect of cooking on the nutritive value of rice and of baking of wheat – bread and biscuit, processing and storage of carbohydrates.Principles involved in the analysis of carbohydrates – analysis of glucose, starch, Benedict method, Anthrone method, Neilson–Somoyogi method, analysis of crude fibers – estimation of carbohydrates in wheat floor.

**TEXT BOOKS:**


1) Advanced Text Book on Food and Nutrition by Swaminathan M. Volume I and II Printing and Publishing CO., Ltd., Bangalore. 1993.
2) Text Book on Food Chemistry by Swaminathan M. Printing and Publishing CO., Ltd., Bangalore. 1993.
3) Food science by Norman N. Potter, CBS publishers and distributors New Delhi. 1994.
4) Food Chemistry by Lillian Hoagol and Meyer CBS publishers and distributors, New Delhi. 1994.


## 19CY5318-MEDICINAL CHEMISTRY

**L-T-P-S: 3-0-0-0** **Credits: 3** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|

| | | | |
|---|---|---|---|
| CO1 | To understand the drug metabolic pathways adverse affects and the therapeutic value of drugs. | PO-2,4 | 3 |
| CO2 | To know the structure activity relationship of the different class of drugs. | PO-1,3 | 3 |
| CO3 | To describe the mechanisms pathways of different class of medicinal compounds. | PSO-1,2 | 3 |
| CO4 | To understand the chemistry of drugs with respect to their pharmacological activity | PO-1,2,3 | 3 |

Syllabus:

Classification and Nomenclature of Drugs. Medicinal chemistry: Important terminology in medicinal chemistry. Classification and Nomenclature of Drugs. Concept of prodrugs and soft drugs. a) Prodrugs: i) Prodrugs designing, types of prodrugs. Prodrug formation of compounds containing various chemical groups, Prodrugs and drug delivery system b) Soft drugs: i) Soft drug concept, ii) Properties of soft drug.Theories of drug activity. i) Occupancy theory, ii) Rate theory, iii) Induced theory. QSAR method: Introduction, Methods used in QSAR studies, Hansch method, Free-Wilson method, Advantages and disadvantages of free approach, Computer based methods of QSAR related to receptor binding, Physico-Chemical properties, Lipophilicity, Electronic parameters, Steric substituent constants, Experimental determination of partition coefficients.Structure based drug design. i) Process of structure based drug design, ii) Deactivation of certain drug, iii) Determination of the structure of the protein, iv) Design of inhibitors. Molecular modelling using computers. i) Introduction ii) Uses of molecular modeling: a) Manual use, b) Further-computer programming, c) X-ray crystallography. Pharmacokinetics and Pharamodynamics. A] Pharmacokinetics: a) Drug absorption, b) Distribution,c) Elimination, d) Disposition. B] Pharmacodynamics. a) Introduction, Elementary treatment of enzyme inhibition, b) Membrane active drug, c) Sulphonamides Mechanism of action of following drugs: Action of CNS disorder, inflammation, cardiac dysfunction. MC-4: Drug metabolism.

**TEXT BOOKS:**


1. Burger's Medicinal Chemistry and Drug Discovery by M.E. Wolf, Vol. I, John Wiley.
2. Goodman and Gilman's Pharmacological Basis of Therapeutics, McGraw-Hill.
3. Organic Chemistry by I.L. Finar, Vol.-2, ELBS.


**19CY5404- SEPARATION TECHNIQUES-II**

**L-T-P-S: 3-0-0-0** **Credits: 3** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Discuss principle of paper chromatography, different techniques and its modification to thin layer chromatography for analytical applications | PO-1,3,4 | 3 |
| CO2 | Apply ion exchange phenomenon employing different resins | PO-1,3 | 3 |

| | | | |
|---|---|---|---|
| | to separate ions and polar molecules of environmental and biological importance | | |
| CO3 | Identify suitable sampling methods of solid, liquid and gas to meet the criteria of analysis | PO-3,5 | 3 |
| CO4 | Develop analytical methods to solve industrial problems and solvent extraction as significant analytical method of purification and separation. | PO-2,3,6 | 3 |

Syllabus:

**Paper chromatography:** principle, papers as a chromatographic medium, modified papers, solvent systems, mechanism of paper chromatography, experimental technique, different development methods-ascending, descending, horizontal, circular spreading, multiple development, two dimensional development, reverse phase paper chromatographic technique-visualization and evaluation of chromatograms, applications. **Thin layer chromatography:** principle, chromatographic media-coating materials, applications, activation of adsorbent, sample development, solvent systems, development of chromatoplate, types of development, visualization methods, documentation, applications in the separation, HPTLC-principle, technique, applications.**Ion Exchange:** principles of ion-exchange systems, synthetic ion-exchange resins, properties of anion and cation exchange resins, ion-exchange mechanism, ion-exchange equilibria, selectivity, ion-exchange capacity, applications of ion-exchangers in different fields. **Ion exchange chromatography:** Principle, Equipment, Application Specifically Separations of Lanthanides, Actinides, amino acids. **Ion chromatography:** principles of separation, instrumentation, detectors, separation of cations and anions, applications in the analysis of water and air pollutants. **Solvent Extraction:** principles and processes of solvent extraction, Distribution Law and Partition coefficient, nature of partition forces, different types of solvent extraction systems Batch extraction, Continuous extraction, Counter current extraction, solvent extraction systems, applications in metallurgy, general applications in analysis and pre-concentration, special extraction systems like crown ethers, super fluid and surfactant extractions-examples.**Analytical Method Developments and validation:** Importance of Qualitative and Quantitative analysis in research and development, industries and other branches of science. Development and validation of an analytical method, units, concentrations, calculations, standards, chemical reactions, expressions of concentrations. Introduction, Dissolution test, Apparatus –USP type –I and II, Sampling and analytical instrumentation, Single point test Vs. Dissolution profile, Calibration, regularatory guidelines, analytical validation, linearity, accuracy, precision, specificity. Limit of quantification, sensitivity, ruggedness and robustness, analyte stability in the sample matrix, how to reduce systematic errors, mean and standard deviation, reliability of results, confidence interval, comparison of results, comparison of two means of two samples, experimental design.Sampling of solids, liquids and gases

**TEXT BOOKS:**

1) Techniques and practice of Chromatography by R.P.W Scott, Marel Dekker Inc., New York.
2) Separation methods by M.N Sastri, Himalaya Publishing Company, Mumbai.

**REFERENCE BOOKS:**

1) Chromatography by E. Helfman, Van Nostrand, Reinhold, New York

2) Chromatography by E. Lederer and M. Lederer, Elsevier, Amsterdam.
3) Chemical separation methods by John A Dean, Von Nostrand Reinhold, New York.
4) Techniques and practice of Chromatography by R.P.W Scott, Marel Dekker Inc., New York.
5) Thin layer chromatography by E.Stahl, Academic Press, New York
6) Ion chromatography by James, G.Tartor

**19CY5405- QUALITY CONTROL AND TRADITIONAL METHODS OF ANALYSIS-II**

**L-T-P-S: 3-0-0-0 Credits: 3 Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Understand the principles of Quality control in Analytical Chemistry | PO-2,4 | 3 |
| CO2 | Explain the various concepts of decomposition techniques in analysis | PO-2,3 | 3 |
| CO3 | Illustrate, discuss and apply the various principles behind the various Red-ox systems involved in the classical Volumetric methods of Analysis. | PO-1,3,5 | 3 |
| CO4 | Explain the various principles involved in the analysis of Organic Functional Groups | PO-1, 4,5 | 3 |

Syllabus:

**Precipitation methods-I** Crystal habit and super saturation, nucleation and crystal growth, homogeneous and heterogeneous nucleation, solubility and particle size, colloids, completeness of precipitation , effect of excess precipitant, pH, complex formation, temperature, purity of precipitates, aging. **Co-precipitation and post precipitation :** theory of adsorption of salts having an ion in common with the main precipitate, co-precipitation in colloidal precipitates, adsorption of solvents, mixed crystal formation by occlusion and entrapment, re-precipitation with examples, Post-precipitation – theory of post-precipitation, examples of post-precipitation, conditions for obtaining pure and quantitative precipitates. **Precipitation Titrations**: Principle, Indicators for precipitation titrations, determination of halides.**Precipitation methods-II: Precipitation from Homogeneous Solution (PFHS):** theory of PFHS, methods of PFHS – increase in pH, decrease in pH, cation release, anion release, reagent synthesis, change in oxidation state, photochemical reactions, precipitation from mixed solvents Applications of PFHS methods. **Gravimetric determinations:** nature of species, preparation of solutions, limitations, interferences, inorganic precipitants-chloride and sulphate, organic precipitants dimethyl glyoxime (DMG), oxine, benzidine, salicylaldoxime, benzoin oxime, sodium tetraphenyl boron, tetraphenyl arsonium chloride. **Electro-gravimetric analysis:** principle, important terms in electrogravimetry, decomposition voltage or decomposition potential, over voltage and their importance, instrumentation, electrolysis at constant current, determination of $Cu^{2+}$ by constant current electrolysis, electrolysis at controlled potentials, determination of Cu, Pb, Sn in brass and bronze by controlled potential electrolysis.**Reductant system – Principles and applications in analysis:** Analytical chemistry of some selected reductant systems – formal, standard and normal potentials in various media, stability of the solutions, species responsible for the reduction properties, standardization, requirement for the selection of the reductants, selection of suitable indicators for various

reductant systems: Inorganic Systems – Cr (II), V (II), Ti (III), Sn (II), Fe (II) in $H_3PO_4$ and hydrazine. Organic Systems: hydroquinone and Ascorbic acid. **Analysis of some selected Drugs:** Basic considerations of drugs – Classification **Determination** of the following Drugs: Acetyl salicylic acid (Antipyretic–Analgesic)**,** Testosterone, progesterone and cortisone (Steroids and corticoids)**,** Sulphadiazine (sulphadrugs)**,** Phenobarbitone (Barbituric acid derivatives)**,** Chloramphenicol, Benzyl penicillin and Tetracycline (Antibiotics).Determination of Thiamine (B1), Riboflavin (B2) and ascorbic acid (c) [Vitamins] Isoniazid (Antimicrobacterial agents)**,** Methlydopa (Antihypertensive agents) Metronidazole (Antiamoebic agents).

**TEXT BOOKS:**


1) Technical methods of analysis by Griffin, Mc Graw Hill Book Co.
2) **C**hemical Separation and measurements by D.G Peterseti, John M.Haves Sanders Co.
3) Chemical analysis by H.A Laitinan, Mc Graw Hill Book Co.
4) Newer redox titrants by Berka, Zyka and Vulterin, Pergamon Press
5) Volumetric Analysis, Vol III by I.M Kolthoff and R.Belvher, Interscience Public, New York
6) Vogel's Text Book of Inorganic Quantitative Analysis by J.Bassett et al, ELBS
7) Pharmaceutical analysis by T. Higuchi, Brochmann hausfen


**REFERENCE BOOKS:**


1) Analytical Chemistry, An Introduction, D.A Skoog, D.M West and F.J Holler, Sanders College Publishing, New York

   Quantitative Chemical Analysis by I.M Kolthoff, E.B Sandel, E.J Meehan, S. Bruckenstein, Macmillan Company, London


## 19CY5406-SENSOR BASED TECHNIQUES AND BODY FLUID ANALYSIS

**L-T-P-S: 3-0-0-0 Credits: 3 Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Understand the principles of various chemical sensors | PO-2,3 | 3 |
| CO2 | Analysis of biomolecules in body fluids | PO-1,2,3 | 3 |
| CO3 | Employ analytical techniques in the determination of vitamins | PO-2,3,6 | 3 |
| CO4 | Apply Immuno analytical Techniques in clinical analysis | PO-3,4,5 | 3 |

Syllabus:

**Chemical Sensors:** Introduction, definitions, Classification of chemical sensors, descriptions of chemical sensors (electrochemical sensors, potentiometric sensors, voltametric chemical sensors, sensors based on conducting properties), Optical sensors (light guides, the evanescent wave, design of fiber optic sensor, indicator mediated sensor), Calorimetric sensors (catalytic gas sensor, thermal conductivity sensor), mass sensor (piezoelectric quartz crystal resonator, surface acostic wave sensor). **Biosensors in analysis:** Introduction, producing biological surface, Achievement of biotransduction (amperometric, potentiometric, optical).**Collection of Specimens:** Blood: Collection of Blood specimens, storage and preservation, Urine: Collection of Urine, physical characteristics of urea, preservation and storage, Faeces: Collection and preservation. **Analysis of Blood and urine**: Determination of blood and plasma glucose by

glucose oxidase method, Determination of urine for glucose, Determination of ketone bodies in blood, Determination of serum creatinin, estimation of serum bilirubin, Estimation of serum cholesterol, determination of blood hemoglobin, Determination of urea in urine by urease method and by direct colorimetry.**Determination of vitamins in body fluid:**Classification of vitamins with example, Each vitamin must be explained with respect of functions, deficiency diseases, daily requirement, and analytical method i) Retinol (determination of retinol and serum carotene in serum using TFA), Vit D3 (Cholecalciferol), Vitamin E (Tocopherols, Determination of serum tocopherol by spectrophotometry by dipyridyl method), Vitamin B1 (thiamine determination by flurometry), Vitamin B2 (riboflavin, Photofluorometric method), Vitamin B6 (Pyidoxine, Fluorometric determination of Xanthuric acid), Nicotinic acid and Niacin: determination by fluorometry, Ascorbic acid (vitamin –c) Volumetric method using 2,6 dichlorophenol method, colorimetric determination of leucocyte ascorbate.**Immunoanalytical Techniques:** Radioimmunoassay, its principle and applications, instrumentation for radio bioassay, clinical application of the radioimmunoassay of insulin, Estrogen and progesterone, receptor techniques of breast cancer. Enzyme- linked immunosorbent assay (ELISA), Types of ELISA, principles, practical aspects, applications.

**TEXT BOOKS:**


1) Standard methods of chemical analysis by F.J. Welcher, 6th Edition,.
2) Quantitative Inorganic Analysis including Elementary Instrumental analysis by A. I. Vogel, 3rd Edition, ELBS, 1964.
3) Instrumental methods of analysis by R. D. Braun
4) Analytical Chemistry, Ed. by Kellner, Mermet, otto, Valcarcel, Widmer, Second Ed. Wiley – VCH
5) Practical Clinical Biochemistry by Gowenlock, CBS published, 6th Ed.
6) Biochemical methods of analysis by S. Sadasivam and A. Manickam, Narosa Publication


## 19CY5410-ADVANCED ORGANIC SPECTROSCOPY

**L-T-P-S: 3-0-0-0** **Credits: 4** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Outline optical rotatory dispersion and circular dichroism. | PO-2,3 | 5 |
| CO2 | Examine the separation of chemical shifts and coupling on 2D axis | PO-1,3 | 5 |
| CO3 | Take part in fragmentation of organic molecules associated with functional groups | PO-1,2,3 | 5 |
| CO4 | Elucidate organic structures using mass fragmentation ORD & CD | PO-1,2,4,5 | 5 |

Syllabus:

Optical Rotatory dispersion and circular dichrosim: phenomenon ORD and CD. Classification of ORD and CD curves; cotton effect curves and their application to Stereochemical problems; the octant rule and its application to alicyclic ketones.The separation of Chemical shift and coupling on to two different axes (2D-NMR, Cosy), spin decoupling, the nuclear overhauser effect

associating the signal from directly bonded $^{13}C$ and $^{1}H$. ESR derivative curves: Values and hyperfine splitting.Fragmentation processes; fragmentation associated with functional groups; rearrangement and mass spectra of some chemical classes. Structural elucidation of Organic Compounds by a combined application of the special method (UV, IR, NMR and Mass).

**TEXT BOOKS:**


1) Spectroscopic Methods in Organic Chemistry by D.M. Williams and I. Fleming Tata McGraw Hill, 4th Edition, New Delhi, 1990. For all spectral methods except ORD and CD and ESR.
2) Organic Spectroscopy by W.Kemp, 2nd Edition, ELBS Macmillan, 1987 for ORD and CD and ESR.
3) Applications of absorption spectroscopy of Organic Compounds by J.R.Dyer, Prentice Hall of India, New Delhi, 1984.
4) Spectrometric identification of Organic Compounds by R.M.Silverstein, G.C.Vasslellr and T.C. Merill, Johne Willey, Singapore, 1981.


## 19CY5411-CHEMISTRY OF DRUGS AND PHARMACEUTICALS

**L-T-P-S: 3-0-0-0** **Credits: 3** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Understand the medicinal and pharmaceutical importance of the organic compounds. | PO-1,2 | 3 |
| CO2 | Explain the Chemical and Biological assay of the various class of compounds. | PSO-1,2 | 3 |
| CO3 | Describe the structure and properties of Vitamins: A, B, C, D, E and K; Hormones: Sex hormones, Steroidal and Non-steroidal hormones, Adrenaline, Thyroxine and Cardiac glycosides etc., | PO-1,4,5 | 3 |
| CO4 | Paraphrase the Pharmalogical activity, uses and limitations of Antipyretics, Analgesics, Sedatives, Hypnotics, Barbiturates, Sulphadrugs, Anaesthetics, Antiseptics, Antibacterials, Diuertics, Anthelmentics, Anticoagulants, Anticonvulsants, Antihistamines, Psychotherupeutics. | PO-1,2,3, | 3 |

Syllabus:

Chemical and Biological assay of the following compounds: Vitamins: A, B, C, D, E and K; Hormones: Sex hormones, Steroidal and Non-steroidal hormones, Adrenaline, Thyroxine and Cardiac glycosides.Penicillin, Streptomycin, Chloromycetin, Tetracyclins, Novobiocin and Cephalosporins.Pharmalogical activity, uses and limitations of Antipyretics, Analgesics, Sedatives, Hypnotics, Barbiturates, Sulphadrugs, Anaesthetics, Antiseptics, Antibacterials, Diuertics, Anthelmentics.Anticoagulants, Anticonvulsants, Antihistamines, Psychotherupeutics.

**TEXT BOOKS**:


1) The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1, 5th Edition, John Wiley & Sons, 2001.
2) Organic Chemistry by IL Finar, Vol. I and II, 5th Edition, ELBS, 2004.
3) Graham L. Patrik, Drug Design and Development, Elsevier Publisher, 2002.

## 19CY5412 – NANO CHEMISTRY

**L-T-P-S: 3-0-0-0** **Credits: 3** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO/PSO | BTL |
|---|---|---|---|
| CO1 | Understand the affects of nano dimensions of particles. | PO-1,2 | 3 |
| CO2 | Exemplify links between nano science and biological systems. | PO-1,3 | 3 |
| CO3 | Describe several synthetic methods for the fabrication of nano particles. | PO-1,2,3 | 3 |
| CO4 | Provide perspectives on future nano chemistry developments. | PO-1,4,5 | 3 |

Syllabus:

Scope and importance of nanoscience and nanotechnology. Synthetic Methods: Chemical Routes: Physical methods, Techniques for characterization.BET method for surface area analysis. Dynamic light scattering for particle size determination.Synthesis, properties and applications of fullerenes, carbon nanotubes, core-shell nanoparticles, self- assembled monolayers, nanocrystalline materials, magnetic nanoparticles thermoelectric materials.
Non-linear optical materials, liquid crystals.

**TEXT BOOKS:**


1) NANO: The Essentials by T. Pradeep, McGraw-Hill, 2007.
2) Textbook of Nanoscience and Nanotechnology by B S Murty, P Shankar, Baldev Rai, B B Rath and James Murday, Univ. Press, 2012.


## PROJECT(SKILL DEVELOPMENT)

## 19CY5403-DISSERTATON WITH RESEARCH PUBLICATION

**L-T-P-S: 0-0-12-0** **Credits: 6** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO | BTL |
|---|---|---|---|
| CO5 | Performing dissertation work and presentation | PO-5,6 | 6 |

## 19CY5409-DISSERTATON WITH RESEARCH PUBLICATION

**L-T-P-S: 0-0-12-0** **Credits: 6** **Prerequisite: NIL**

**Mapping of Course outcomes (CO) with program outcomes (PO) with BTL:**

| CO# | Course Outcome | PO | BTL |
|---|---|---|---|
| CO5 | Performing dissertation work and presentation | PO-5,6 | 6 |