

**Veer Bahadur Singh Purvanchal University, Jaunpur**  
**Department of Higher Education**  
**U.P. Government, Lucknow**  
 Nation Education Policy-2022  
 Common Minimum syllabus for all U.P. State Universities and Colleges  
**M.Sc. Industrial Chemistry**

Year	Sem.	Course Code	Paper Title	Theory/Practical	Credits
4	VII	B190101T	Inorganic Chemistry	Theory	5
4	VII	B190102T	Organic Chemistry	Theory	5
4	VII	B190103T	Physical Chemistry	Theory	5
4	VII	B190104T	Analytical Techniques-I	Theory	5
4	VII	B190105T	Minor Elective from other faculty	Theory	4
4	VII	B190106P	Practical	Practical	4
4	VIII	B190201T	Inorganic Concepts in Industrial Chemistry	Theory	5
4	VIII	B190202T	Basic Organic Concepts in Industrial Chemistry	Theory	5
4	VIII	B190203T	Basic Physical Concepts in Industrial Chemistry	Theory	5
4	VIII	B190204T	Analytical Techniques-II	Theory	5
4	VIII	B190205P	Practical	Practical	4
5	IX	B190301T	Advance Spectroscopic Methods	Theory	5
5	IX	B190302T	Chemistry in Industrial Processes-I	Theory	5
5	IX	B190303T	Common Chemicals in Industries	Theory	5
5	IX	B190304T	Unit Operation and process utilities	Theory	5
5	IX	B190305P	Practical	Practical	4
5	X	B190401T	Chemistry in Industrial Processes-II	Theory	5
5	X	B190402T	Water Management and Industrial Pollution	Theory	5
			<b>Elective Papers any two</b>		
5	X	B190403T	E1- Pharmaceutical Chemistry	Theory	5
5	X	B190404T	E2- Polymers	Theory	5
5	X	B190405T	E <sub>3</sub> Chemistry of materials	Theory	5
5	X	B190406T	E <sub>4</sub> Organic Synthesis-II	Theory	5
5	X	B190407P	Practical	Practical	4

**Syllabus Developed by:**

S.N.	Name	Designation	Department	Collage/University
1.	Dr. Amaresh Kumar	Associate Professor and Head	Chemistry	Kutir P. G. Collage, Chakkey, Jaunpur,U.P.

## M.Sc. I Semester

### Paper-I Inorganic Chemistry

(Paper Code- B190101T) Credit-5

		No.of Lectures
<b>Unit-I</b>	<b>Symmetry and Group Theory in Chemistry</b> Symmetry elements and symmetry operation, definitions of groups, subgroups Point symmetry group, representation of groups by matrices (representation of the $C_n$ , $C_{nv}$ , $C_{nh}$ , $D_{nh}$ etc groups to be worked out explicitly), Characters of a representation, Character tables and their use in spectroscopy.	<b>10</b>
<b>Unit-II</b>	<b>Stereochemistry and Bonding in Main Group Compounds</b> VSEPR Theory, Walsh diagrams (tri and penta-atomic Molecules), $d\pi$ - $p\pi$ bonds, bent rule and energetics of hybridization, some simple reactions of covalently bonded molecules.	<b>10</b>
<b>Unit-III</b>	<b>Metal-Ligand Bonding</b> Limitation of crystal field theory, molecular orbital theory, Octahedral, tetrahedral and square planar complexes, $\pi$ -bonding and molecular orbital theory.	<b>10</b>
<b>Unit-IV</b>	<b>Metal-Ligand Equilibria in Solution</b> Stepwise and overall formation constants and their interaction, trends in stepwise constants, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand, chelate effect and its thermodynamic origin, determination of binary formation constants by pH-metry and spectro-photometry.	<b>10</b>

#### Books Recommended:

1. F.A. Cotton and G. Wilkinson Advanced Inorganic Chemistry, 6th Edn.(1999), John Wiley & Sons, New York.
2. James E. Huheey, Inorganic Chemistry, 4th Edn. (1993), Addison-Wesley Pub. Co., New York.
3. Comprehensive Coordination Chemistry eds., G Wilkinson, R. D. Gillars and J. A. McCleverty, Pergamon.
4. Magneto Chemistry, R. L. Carlin, Springer Verlag.
5. F.A. Cotton and G. Wilkinson Advanced Inorganic Chemistry, 6th Edn.(1999), John Wiley & Sons, New York.
6. Inorganic Electronic Spectroscopy, A. B. P. Lever, Elsevier.
7. Comprehensive Coordination Chemistry eds., G Wilkinson, R. D. Gillars and J. A. Mc Cleverty.

**M.Sc. I Semester**  
**Paper-II Organic Chemistry**  
**(Paper Code- B190102T) Credit-5**

<b>Unit-I</b>	<p><b>Nature of bonding in Organic Molecules</b>  Resonance, hyper-conjugation, Aromaticity in benzenoid and non-benzenoid compounds, Huckel's rule, energy level of pi-molecular orbitals, annulenes, antiaromaticity.</p>	<b>10</b>
<b>Unit-II</b>	<p><b>Stereochemistry</b>  Conformational analysis of mono and disubstituted cyclohexane, effect of conformation on reactivity, elements of symmetry, stereospecific and stereoselective synthesis, Asymmetric synthesis, Optical activity in the absence of chiral carbon, biphenyls, allenes and spiranes.  Methods for determination of reaction mechanism, isotope effect, generation, structure, stability and reactivity of benzyne, carbenes and nitrenes, effect of structure on reactivity: resonance and field effect, steric effect, quantitative treatment.</p>	<b>10</b>
<b>Unit-III</b>	<p><b>Aliphatic nucleophilic substitution</b>  The <math>SN^2</math>, <math>SN^1</math>, mixed <math>SN^1</math> and <math>SN^2</math>, the neighboring group mechanism, neighboring group participation by Pi and Sigma bonds, anchimeric assistance Classical and non classical carbocations, The <math>SN^1</math> mechanism nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon, Reactivity, effects of substrate structure, attacking nucleophile, leaving group and reaction medium, ambident nucleophile, regioselectivity.</p>	<b>10</b>
<b>Unit-IV</b>	<p><b>Aromatic electrophilic substitution</b>  The arenium ion mechanism, orientation and reactivity, energy profile diagrams, The Ortho/Para ratio, ipso attack, orientation in other ring systems, Vilsmeier reaction, Gattermann-Koch reaction.  <b>Aromatic nucleophilic substitution</b>  The <math>ArSN^1</math>, Benzyne and <math>ArSN^2</math> mechanism, Reactivity effect of substrate structure, leaving group and attacking nucleophile, The Von Richter, Sommelet-Hauser, and Smiles rearrangements.</p>	<b>10</b>

**Books Recommended:**

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sundberg, Plenum.
3. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
4. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Cornell University press.
5. Organic Chemistry, R.T. Morrison and R.N. Boyd. Prentice Hall.
6. Modern Organic Chemistry H.O. House, Benjamin
7. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic and professional.
8. Pericyclic Reactions. S.M. Mukherji, Macmillan India.
9. Reaction Mechanism in Organic Chemistry : S.M. Mukherji and S.P. Singh, Macmillan.
10. Stereochemistry of Organic Compounds D. Nasipuri, New Age International.
11. Stereochemistry of Organic Compounds, P.S Kalsi, New Age, International.

**M.Sc. I Semester**  
**Paper-III Physical Chemistry**  
**(Paper Code- B190103T) Credit-5**

<b>Unit-I</b>	<p><b>Microwave Spectroscopy</b>            Classification of molecules, rigid rotor model, Effect of isotopic substitution on the transition frequencies intensities, non rigid rotor, Stark effect, Applications.            Born Oppenheimer approximation, rotational, vibrational and electronic energy levels.</p>	<b>10</b>
<b>Unit-II</b>	<p><b>Vibrational Spectroscopy</b>            Infrared Spectroscopy, Review of linear harmonic oscillator, vibrational energies of diatomic molecules, zero point energy, force constant and bond strength; anharmonicity, P.Q.R. branches, vibrations of polyatomic molecules, Selection rules, normal modes of vibration, factors affecting, the band positions and intensities.            Classical and quantum theories of Raman effect, Pure rotational, vibrational and vibrational-rotational Raman spectra, selection rules, mutual exclusion principle, Applications of Raman spectroscopy.</p>	<b>10</b>
<b>Unit-III</b>	<p><b>Quantum Chemistry</b>            Operators, Postulates of Quantum Mechanics, Hamiltonian for different systems, Angular momentum, The Schrodinger equation, discussion of solutions of the Schrodinger equation to some model system viz, particle in a box, the harmonic oscillator, the rigid rotar, the hydrogen atom. Approximate Methods: The Variation theorem, linear variation principle, Perturbation theory (First order and nondegenerate), Application of variation method and perturbation theory to the Helium atom.</p>	<b>10</b>
<b>Unit-IV</b>	<p><b>Chemical Dynamics</b>            Methods of determining rate law, collision theory of reaction rates steric factors Activated complex theory, Arrhenius equation and the activated complex theory, Ionic reactions kinetic salt effect, steady state kinetics. Dynamic chain( hydrogen-bromine reaction, pyrolysis of acetaldehyde) photochemical (hydrogen bromine reactions) and oscillatory reactions (Belousav Zhabotinsky reaction) homogeneous catalysis, kinetics of enzyme reaction General features of fast reaction study of fast reaction by relaxation method, flash photolysis and the nuclear magnetic resonance method.</p>	<b>10</b>

**Books Recommended:**

1. Modern Spectroscopy, J.M. Hollas, John Wiley.
2. Physical methods in Chemistry, RS. Drago, Saunders College.
3. Introduction to Molecular Spectroscopy G.M. Barrow, Mc Graw Hill.
4. Physical Chemistry P.W. Atkins, ELBS.
5. Introduction to Quantum Chemistry, A.K. Chandra, Tata Mc Graw Hill.
6. Quantum Chemistry, Ira N. Levine. Prentice Hall.
7. Coulson's Valence, R.McWeeny, ELBS.
8. Chemical Kinetics, K.J. Laidler, McGraw-Hill.
9. Kinetics and Mechanism of Chemical Transformations J. Rajaraman and J. Kuriacose Mc Millan.
10. Micelles, Theoretical and Applied Aspects, V. Moroi, Plenum .
11. Modern Electrochemistry Vol. I and Vol. II J.O.M. Bockris and AK.N. Reddy, Plenum.
12. Introduction to Polymer Science V.R. Gowariker, N.V. Vishwanathan and J.Sridhar, Wiley Eastern.

## M.Sc. I Semester

### Paper-IV Analytical Techniques-I

(Paper Code- B190104T) Credit-5

<b>Unit-I</b>	<b>Turbidimetry/Nephelometry:</b> Principle and instrumentation for nephelometry and turbidimetry, effect of concentration, particle size and wavelength on intensity of scattered light, applications to analysis, turbidimetric titrations, determination of molecular weight of a polymer.	<b>10</b>
<b>Unit-II</b>	<b>Solvent Extraction:</b> Distribution law, batch and continuous extractions, synergistic extraction, ion-association complexes, soxhlet extraction, Extraction of drug from the biological matrix -Solid Phase Extraction.	<b>10</b>
<b>Unit-III</b>	<b>Chromatography:</b> Classification, theories of chromatographic methods, principles and methods of chromatographic separation by paper, TLC, preparative TLC, HPTLC, column, HPLC, gas chromatography and ion-exchange chromatography. Instrumentation of HPLC and GC, types of columns and detectors for GC, Applications of chromatographic methods, an introduction to LC-MS technique.	<b>10</b>
<b>Unit-IV</b>	<b>Volatametry and Polarography:</b> Principle and instrumentation, concept and expressions of diffusion current, half-wave potential, residual current, DME, current-potential curve and reversible reactions, qualitative and quantitative applications of polarography, types and advantages of amperometric titrations.	<b>10</b>

#### BOOKS RECOMMENDED:

1. "Vogel's Textbook of Quantitative Chemical Analysis", Bassette and coworkers, Longman Group UK Ltd.
2. "Instrumental methods of analysis", M.H. Willard, L.L. Merrit, J.A. Dean & F.A. Settle.
3. "Principles of polarography", R.C. Kapoor and B.S. Aggarwal, Wiley Eastern Ltd.
4. "Principles and practice of analytical chemistry", F.W. Fifield and D. Kaley, Blackie Academic & Professional 4<sup>th</sup> Ed. (1995).

## M.Sc.I Semester

### Practicals\_(Paper Code- B190106P) Credit-4

<b>Unit-I</b>	<b>Inorganic Chemistry</b> 1- Qualitative analysis of mixture containing trace elements Tl, Mo, W, Zr, Ti, Th, V, U (Two metal ions in cationic/anionic forms) and insoluble oxides, sulphates and halides. The mixture should not contain more than five cations and should be analyzed by semi micro technique. 2- Thin layer chromatography separation of a mixture of the following and measurements of $R_f$ values. (a) $Pb^{+2}$ , $Ag^+$ , $Hg^{+2}$ (b) $Co^{+2}$ , $Ni^{+2}$ , $Cu^{+2}$ (c) $Ba^{+2}$ , $Ca^{+2}$ , $Sr^{+2}$	<b>15</b>
<b>Unit-II</b>	<b>Organic Chemistry</b> 1. Separation, purification, and identification of ternary mixture. Preparation of derivatives, if possible. 2. Quantitative Analysis (Any one): a. Determination of the percentage or number of hydroxyl groups in an organic compound by acetylation method. b. Estimation of amine/phenols using bromate bromide solution or acetylation method. c. Determination of iodine and saponification values of an oil sample.	<b>15</b>
<b>Unit-III</b>	<b>Physical Chemistry (Any two):</b> a. Study the adsorption of acetic acid on charcoal and draw the Freundlich isotherm. b. Show that the order of reaction between acetone and Iodine is zero with respect to Iodine. c. Determination of congruent composition and temperature of a binary mixture e.g. diphenylamine-benzophenone system. d. Determination of the velocity constant of hydrolysis of an ester / ionic reaction in micellar media. e. Determination of the velocity constant of decomposition of Benzene diazonium chloride. f. Determination of molecular weight of nonvolatile and nonelectrolyte/ electrolyte by cryoscopic method and to determine the activity coefficient of an electrolyte. g. Determination of DO, COD and BOD of water sample.	<b>10</b>

## M.Sc. II Semester

### Paper-I\_Inorganic Concepts in Industrial Chemistry

(Paper Code- B190201T) Credit-5

<b>Unit-I</b>	<b>Reaction mechanism of Transition Metal Complexes</b> Energy profile of a reaction, reaction reactivity of metal complexes, inert and labile complexes, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism, anation reaction, reactions without metal ligands bond cleavage, Substitution reaction in square planar complexes, outer sphere type reactions,, cross- reactions and Marcus-Hush theory, inner sphere type reactions.	<b>10</b>
<b>Unit-II</b>	<b>Kinetic application of valence bond and crystal field theories.</b> kinetics of octahedral substitution, Redox reactions, electron transfer reactions, mechanism of one electron transfer reactions,	<b>10</b>
<b>Unit-III</b>	<b>Electronic spectra and Magnetic Properties of Transition Metal Complexes:</b> Spectroscopic ground states; Orgel energy level and Tanabe-Sugano diagrams for transition metal complexes ( $d^1$ - $d^9$ states); Charge transfer spectra; electronic spectra of octahedral and tetrahedral Co(II) and Ni(II) complexes and calculation of ligand-field parameters.	<b>10</b>
<b>Unit-IV</b>	<b>Metal <math>\pi</math>-Complexes and Clusters</b> Metal carbonyls, structure and bonding, vibrational spectra of Metal carbonyls for bonding and structural elucidation, important reactions of Metal carbonyls, preparation, bonding, Structure and important reactions of transition metal nitrosyl, dinitrogen and dioxygen complexes, tertiary phosphine as ligand, Higher boranes, carboranes, metallocarboranes, B- Isopoly and heteropoly acids and salts	<b>10</b>

#### Books Recommended:

1. F.A. Cotton and G. Wilkinson Advanced Inorganic Chemistry, 6th Edn.(1999), John Wiley & Sons, New York.
2. James E. Huheey, Inorganic Chemistry, 4th Edn. (1993), Addison-Wesley Pub. Co., New York.
3. Comprehensive Coordination Chemistry eds., G Wilkinson, R. D. Gillars and J. A. McCleverty, Pergamon.
4. Magneto Chemistry, R. L. Carlin, Springer Verlag.
5. F.A. Cotton and G. Wilkinson Advanced Inorganic Chemistry, 6th Edn.(1999), John Wiley & Sons, New York.
6. Inorganic Electronic Spectroscopy, A. B. P. Lever, Elsevier.
7. Comprehensive Coordination Chemistry eds., G Wilkinson, R. D. Gillars and J. A. McCleverty.

## M.Sc. II Semester

### Paper-II\_Basic Organic Concepts in Industrial Chemistry

(Paper Code- B190202T) Credit-5

<b>Unit-I</b>	<b>Addition to carbon-carbon multiple bond:</b> Mechanistic and stereochemical aspects of addition reactions involving electrophile, nucleophile and free radicals, regio and chemo selectivity, orientation and reactivity, Hydrogenation of aromatic rings, Hydroboration, Michael reaction, Sharpless asymmetric epoxidation.	<b>10</b>
<b>Unit-II</b>	<b>Addition to carbon heteroatom multiple bonds:</b> Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acids, esters and nitriles, Wittig reaction mechanism of condensation reactions involving enolate, Knoevenagel, Mannich, Stobbe reactions, Hydrolysis of esters and amides, ammonolysis of esters.	<b>10</b>
<b>Unit-III</b>	<b>Free radical reactions:</b> Free radical substitution mechanism, mechanism at an aromatic substrate, neighbouring group assistance, Reactivity for aliphatic and aromatic substrates at a bridgehead, Effect of solvent on reactivity, Arylation of aromatic compounds by diazonium salt, Hunsdiecker reaction.	<b>10</b>
<b>Unit-IV</b>	<b>Pericyclic reactions:</b> Molecular orbital symmetry, frontier orbitals of ethylene, 1, 3-butadiene, 1,3,5-hexatriene and allyl system, Classification of pericyclic reactions, Woodward-Hoffmann correlation diagrams. FMO approach, Electrocyclic reactions- conrotatory and disrotatory motions, $4n$ , $4n+2$ and allyl systems, Cycloadditions-antarafacial and Suprafacial additions, $4n$ and- $4n+2$ system, Sigmatropic rearrangements-suprafacial and antarafacial shift of H, sigmatropic shifts involving carbon moieties, 3, 3 and 5, 5 sigmatropic rearrangements, Claisen-Cope and Azacope rearrangement, Fluxional tautomerism, Ene reaction.	<b>10</b>

#### Books Recommended:

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sundberg, Plenum.
3. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
4. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Cornell University press.
5. Organic Chemistry, R.T. Morrison and R.N. Boyd. Prentice Hall.
6. Modern Organic Reactions H.O. House, Benjamin
7. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic and professional.
8. Pericyclic Reactions. S.M. Mukherji, Macmillan India.
9. Reaction Mechanism in Organic Chemistry : S.M. Mukherji and S.P. Singh, Macmillan.
10. Stereochemistry of Organic Compounds D. Nasipuri, New Age International.
11. Stereochemistry of Organic Compounds, P.S Kalsi, New Age, International.



**M.Sc. II Semester**  
**Paper-III\_Basic Physical Concepts in Industrial Chemistry**  
**(Paper Code- B190203T)Credit-5**

<b>Unit-I</b>	<p>Thermodynamics</p> <p>a. Classical Thermodynamics: Brief resume of concepts of laws of thermodynamics, free energy and chemical potential. Partial, molar properties partial molar free energy, partial molar volume and its determination, Gibbs–Duhem equation, concept of fugacity (by graphical method), Activity and Activity coefficient.</p> <p>b. Statistical Thermodynamics: Concept of distribution, thermodynamic probability and most probable distribution, Canonical, grand canonical and microcanonical ensembles, The Boltzmann distribution law, Partition Functions-translational, rotational, vibrational and electronic partition function. Calculation of thermodynamic properties and equilibrium constant in terms of partition function. Fermi-Dirac and Bose-Einstein statistics.</p> <p>c. Non-Equilibrium Thermodynamics: Thermodynamic criteria for non-equilibrium states, entropy production and entropy flow, Entropy balance equation for different irreversible processes (e.g heat flow chemical reaction etc. Transformation of the generalized fluxes and forces non-equilibrium stationary, phenomenological equations, Onsager’s reciprocity relation, electro kinetic phenomena.</p>	<b>10</b>
<b>Unit-II</b>	<p>Surface chemistry:</p> <p>a. Adsorption: Gibbs adsorption isotherm estimation of surface area (BET equation), surface films on liquids (Electro kinetic phenomenon), catalytic activity at surfaces.</p> <p>b. Micelles: Surface active agents, classification of surface active agents, micellization hydrophobic interactions, Critical micellar concentration (CMC), Factors affecting CMC of surfactants counter ion binding to Micelles, solubilization, micro emulsion reverse micelles.</p>	<b>10</b>
<b>Unit-III</b>	<p>Macromolecules:</p> <p>Polymer-definition, types of polymer, electrically conducting fire resistant, liquid crystal polymer, Kinetics of polymerization, Molecular mass, number and mass average molecular mass, molecular mass determination (Osmometry, Viscometry, diffusion and light scattering method) sedimentation chain configuration of macromolecules, Calculation of average dimension of various chain structures.</p>	<b>10</b>
<b>Unit-IV</b>	<p>Electrochemistry:</p> <p>Debye- Huckel theory of activity coefficient of electrolytic solutions, applicability and limitations of Debye-Huckel limiting law, ionic strength, structure of electrified interfaces, Helmholtz- perrin, Guoy-Chapman and stern models, Over potentials, exchange current density, derivation of Butler-volmer equation, Tafel plot. Electrocatalysis, Influence of various parameters, Hydrogen electrode, Polarographytheory, interpretation of a polarographic curve, instrumentation, limiting current, residual and charging current, diffusion current. Supporting electrolytes, Elkovic equation, half wave potential and its significance. Introduction to corrosion, homogeneous theory, forms of corrosion, corrosion monitoring and prevention methods.</p>	<b>10</b>

**Books Recommended:**

1. Modern Spectroscopy, J.M. Hollas, John Wiley.
2. Physical methods in Chemistry, R.S. Drago, Saunders College.
3. Introduction to Molecular Spectroscopy G.M. Barrow, Mc Graw Hill.
4. Physical Chemistry P.W. Atkins, ELBS.
5. Introduction to Quantum Chemistry, A.K. Chandra, Tata Mc Graw Hill.
6. Quantum Chemistry, Ira N. Levine. Prentice Hall.
7. Coulson's Valence, R.McWeeny, ELBS.
8. Chemical Kinetics, K.J. Laidler, McGraw-Hill.
9. Kinetics and Mechanism of Chemical Transformations J. Rajaraman and J .Kuriacose Mc Millan.
10. Micelles, Theoretical and Applied Aspects, V. Moroi, Plenum .
11. Modern Electrochemistry Vol. I and Vol. II J.O.M. Bockris and AK.N. Reddy, Plenum.
12. Introduction to Polymer Science V.R. Gowariker, N.V. Vishwanathan and J.Sridhar, Wiley Eastern.

## M.Sc. II Semester

### Paper-IV\_Paper-IV\_Analytical Techniques-II

(Paper Code- B190204T) Credit-5

<b>Unit-I</b>	<b>A. Atomic Absorption Spectroscopy (AAS):</b> Introduction, principle, instrumentation, detection limits, sensitivity, interferences, comparison of AAS with flame photometry, applications. <b>B. Flame photometry:</b> Introduction, principle and instrumentation of flame photometry, experimental techniques – standard addition method and internal standard method, interferences in flame photometry and applications.	<b>10</b>
<b>Unit-II</b>	<b>A. Fluorescence and Phosphorescence:</b> Basic principles filter fluorometer and double beam monochromator instruments, working, analysis of rare earths, pharmaceuticals, optical brightness, ultra trace analysis, new materials. <b>B. Mössbauer Spectroscopy:</b> Introduction, principle, Mössbauer nuclides, parameters required for evaluation, instrumentation, applications.	<b>10</b>
<b>Unit-III</b>	<b>Thermal analysis:</b> Introduction to thermal analysis, Differential Thermal Analysis (DTA), Thermogravimetry (TG) and Differential Thermogravimetry (DTG), static and dynamic thermogravimetry; Instrumentation and applications, Introduction to Differential Scanning Calorimetry (DSC), types and its applications.	<b>10</b>
<b>Unit-IV</b>	<b>Mass Spectrometry:</b> Electron impact line diagram of mass spectrometer, mass spectrum, metastable ion, nitrogen rule, molecular weight determination, molecular formula from isotopic ratio data, isotopic profile of halogen compounds, factors effecting reaction pathways, fragmentation patterns – simple cleavage, retro – Diels Alder, hydrogen transfer, Rearrangement – like scrambling, ortho effect, McLafferty rearrangement. Fragmentation pattern of hydrocarbons, alcohols, phenols, ethers, aldehydes, ketones, esters, carboxylic acids, amines, nitro, amides, nitriles. An elementary idea of chemical ionization and negative Ion mass spectrometry. A brief introduction to LC-MS technique.	<b>10</b>

#### BOOKS RECOMMENDED:

1. Introduction to spectroscopy by D.L. Pavia et. al. Saunders Golden Sunburst Series 1996.
2. "Spectrometric identification of organic compounds", R.M. Silverstein, G.S. Bassler & T.C. Morrill, John Wiley & Sons, New York.
3. "An Introduction to spectroscopy methods for identification of organic compounds." F. Scheinman, Vol. I & II, Pergamon Press.
4. "Spectroscopy of organic compound", P.S. Kalsi, Wiley Eastern, New Delhi.
5. "Organic Mass Spectrometry", K.G. Das & E.P. James, Oxford & IBH Publishing Co.
6. "Instrumental methods of analysis", M.H. Willard, L.L. Merritt, J.A. Dean and F.A. Settle, 7th Ed. (1988).
7. Absorption Spectroscopy of Organic Molecules (D.Van Nostrand), V. M. Parikh
8. "Spectroscopy" Pragati Prakashan by H.Kaur.

**M.Sc.II Semester**  
**Practical's (Paper Code- B190204P) Credit-5**

<b>Unit-I</b>	<p><b>Inorganic Chemistry</b>            1-Quantitative and separation and determination of the following pairs of metals ions using gravimetric and volumetric methods respectively (any one)            (a). Ni<sup>2+</sup> and Cu<sup>2+</sup>            (b). Cu<sup>2+</sup> and Zn<sup>2+</sup>            (c). Ba<sup>2+</sup> and Cu<sup>2+</sup>            (d). Mg<sup>2+</sup> Ca<sup>2+</sup>            2-Preparation of selective inorganic compounds (any one)            (a). VO (acac)<sub>2</sub>,            (b). Na[Cr(NH<sub>3</sub>)<sub>2</sub>(SCN)<sub>4</sub>]            (c). K<sub>3</sub>[Fe(C<sub>2</sub>O<sub>4</sub>)<sub>3</sub>]            (d). [Co (Py)<sub>2</sub>Cl<sub>2</sub>]            (e). [Cu(NH<sub>3</sub>)<sub>4</sub>]SO<sub>4</sub>.H<sub>2</sub>O</p>	<b>15</b>
<b>Unit-II</b>	<p><b>Organic Chemistry</b>            1-Organic Synthesis (any one):            a. Eosin from phthalic anhydride.            b. Benzene azo-β-naphthol(Dye)            c. Bakelite (Polymer).            d. Acetyl salicylic acid (Aspirin).            e. Synthesis of p-hydroxyacetanilide (Paracetamol).            2- Separation and estimation of R<sub>f</sub> value of amino acids by paper chromatography.</p>	<b>15</b>
<b>Unit-III</b>	<p><b>Physical Chemistry (Any two):</b>            a. Determination of glass transition temperature of a given salt (e.g., CaCl<sub>2</sub>) conductometrically.            b. Determination of the degree of dissociation of weak electrolyte and to study the deviation from ideal behaviour that occurs with a strong electrolyte.            c. Determination of the velocity constant, order of the reaction and energy of activation for saponification of ethyl acetate by sodium hydroxide conductometrically.            d. Determination of solubility and solubility product of sparingly soluble salts (e.g PbSO<sub>4</sub>, BaSO<sub>4</sub>) conductometrically.            e. Determination of the strength of strong and weak acids in a given mixture conductometrically.            f. Potentiometric titration of strong acid and strong base.            g. Kinetics of oxidation of lactose/maltose by potassium ferricyanide in presence of sodium hydroxide.</p>	<b>10</b>

**M.Sc. III Semester**  
**Paper-I\_Advance Spectroscopic Methods**  
**(Paper Code- B190301T) Credit-5**

<b>Unit-I</b>	<b>Infrared (IR) Spectroscopy:</b> Introduction, principles of IR spectroscopy, sample handling, various modes of vibrations, presentation of spectra, functional group and finger print region, combination and overtones, Fermi resonance, bond properties and absorption trends, factors influencing vibration frequencies, interpretation of IR spectra, introduction of FT-IR spectroscopy.	<b>10</b>
<b>Unit-II</b>	<b>Nuclear Magnetic Resonance (NMR) Spectroscopy:</b> Principles of NMR spectroscopy, nuclear spin states, nuclear magnetic moments, absorption of energy, chemical shift and its measurements, shielding and deshielding of protons, anisotropy, chemical shift and chemical equivalence, integrals, spin-spin splitting, N+1 rule, mechanism of coupling and coupling constants, presentation of spectra, magnetic equivalence, allylic coupling, exchangeable protons, Interpretation of NMR spectra of simple organic compounds, effect of enantiotopic, diastereotopic protons, Karplus curves- Variation of coupling constant with dihedral angles. Techniques of simplifying NMR spectra, double resonance, shift reagents and deuteration, elementary idea of C <sup>13</sup> NMR, Introduction to FT-NMR spectroscopy.	<b>10</b>
<b>Unit-III</b>	<b>ESR Basic concepts, 'g' value hyperfine splitting, ESR of hydrogen atom, free radicals, ESR of solids, ESR of simple free radical in solutions, spin densities, spin polarization anisotropy of Zeeman and hyperfine interactions.</b>	<b>10</b>
<b>Unit-IV</b>	X-ray Production of X-rays, X-ray spectra, absorption of X-rays, analysis by absorption edge analysis, absorption apparatus, determination of molecular structure by X-ray diffraction, crystal morphology, lattice and unit cells, kinds, space lattice, planes or faces of cubic systems, labeling the planes, the Miller indices, spacing of the planes, X-ray crystallography, the powder method, the rotating crystal methods.	<b>10</b>

**Books Recommended:**

1. F.A. Cotton and G. Wilkinson Advanced Inorganic Chemistry, 6th Edn.(1999), John Wiley & Sons, New York.
2. James E. Huheey, Inorganic Chemistry, 4th Edn. (1993), Addison-Wesley Pub. Co., New York.
3. Comprehensive Coordination Chemistry eds., G Wilkinson, R. D. Gillars and J. A. McCleverty, Pergammon.
4. Magneto Chemistry, R. L. Carlin, Springer Verlag.
5. F.A. Cotton and G. Wilkinson Advanced Inorganic Chemistry, 6th Edn.(1999), John Wiley & Sons, New York.
6. Inorganic Electronic Spectroscopy, A. B. P. Lever, Elsevier.
7. Comprehensive Coordination Chemistry eds., G Wilkinson, R. D. Gillars and J. A. McCleverty.

## M.Sc. III Semester

### Paper-II\_Chemistry in Industrial Processes-I

(Paper Code- B190302T) Credit-5

<b>Unit-I</b>	<b>Material and energy balance:</b> <b>A. Material balance:</b> Process classification, Choice of system and basis of molecular processes with chemical reactions, Material balance calculations, Multiple unit processes, Recycle and bypass. <b>B. Energy balance:</b> Forms of energy, Energy balance, Energy changes in physical processes, Energy changes in reactions, Energy balance Calculations.	<b>10</b>
<b>Unit-II</b>	<b>Equipment Design:</b> <b>A. Material of constructions:</b> Mechanical properties, Corrosion resistance, Plastics. Metals and alloys, Stainless steel, Special material for food and pharmaceutical equipment, Protective coatings, Surface treatment to metals for corrosion resistance. <b>B. Design of Vessels:</b> Classification of chemical reactors, pressure vessels for internal or external pressure, Maintenance, Storage vessels for liquids and gases, Design of chemical reactors, Reactors with chemical addition, agitation, heating, removal of vapours, gas addition.	<b>10</b>
<b>Unit-III</b>	<b>Industrial Instrumentation:</b> Measurement of temperature, Thermo couples and pyrometers, High temperature thermometers, Optical pyrometers, Measurement of pressure and vacuum, Manometric and Bourdon gauges, Vacuum gauges, Ionization and pirani gauges. Flow measurement, Pitot tube, Rotameters, Liquid level indicators. Hook Type, Sight glass, Float type, Capacitance level indicator, Radiation level indicator.	<b>10</b>
<b>Unit-IV</b>	<b>Industrial Waste Management:</b> Definition, Classification, sources and composition of solid, liquid and gaseous wastes, hazardous and non-hazardous wastes, special waste materials, Storage and transport of wastes, Management of wastes, minimization, reuse and recycling, waste utilization and, anaerobic digestion, combustion and incineration.	<b>10</b>

#### Recommended Books:

1. A.M. Martin: Bio-conservation of waste Materials to Industrial Products; (ed), Elsevier, Amsterdam.
2. O.P. Kharbanda and E. A. Stellworthy: Waste Management- towards a Sustainable Society, Gower.
3. E. Mortensen: Introduction to Solid Waste, Lecture Notes to Graduate Diploma in Environmental Engineering, University College, Ireland.
4. R.K. Somasekhar and Mariyengar (ED): Solid Waste Management- Current Status and Strategies for Future, , Allied Publishers, Mumbai.
5. R. N. Shreve: The Chemical Process Industries (MGH)
6. W. I. Badger and J. T. Bandchero: Introduction to Chemical Engineering (MGH)
7. O. A. Hougen, R. M. Watson and R. A. Ragetz: Chemical Process Principles (Vol. I, II (JW))
8. P. H. Groggins: Unit processes in organic synthesis (MGH)
9. S. Glasstone: Textbook of Physical Chemistry, II<sup>nd</sup> Edn. (McMillan India LTD. 1996)
10. Industrial Instrumentation and Control by S. K. Singh Tata McGraw-Hill Publishing Company Limited, New Delhi.

**M.Sc. III Semester**  
**Paper-III Common Chemicals in Industries**  
**(Paper Code- B190303T) Credit-5**

<b>Unit-I</b>	<p><b>A. Dairy Chemistry:</b> Milk and milk products, composition and structure of milk, milk proteins, enzymes, vitamins, minerals, density and viscosity of milk, effect of heat on milk, milk processing, basic milk categories, butter, ghee and clarified butter.</p> <p><b>B. Leather Chemistry:</b> Introduction, constituents of animal skin, manufacture and preparation of hides, cleaning, soaking, limiting and degreasing, finishing and sharing, tanning; leather, vegetable, chrome, tanning effluents; pollution and control.</p>	<b>10</b>
<b>Unit-II</b>	<p><b>A. Dyes and Pigments:</b> Classification of Dyes, Methods of preparation of commercial dyes of different classes with suitable examples. Typical manufacturing processes of few dyes, Fluorescent brightening agents, Photosensitive dyes, dyes as food additives, natural dyes.</p> <p><b>B. Oils, Soaps and Detergents:</b> Refining of edible oils, Manufacturing of soaps, Detergents, Liquid Soaps. Manufacturing of fatty Acids and glycerol, greases from fatty acids, turkey –red oil.</p>	<b>10</b>
<b>Unit-III</b>	<p><b>Food Chemistry:</b> Classification, chemical composition and nutritional value of common food stuffs, properties of foods, food preservation and processing, food deterioration, methods of preservation and processing by heat, cold, chill storage, deep freezing, drying, concentration, fermentation, and radiation, Food quality; sensory evaluation, objective methods, non-nutritional constituents and food safety.</p> <p>Permitted food additives and their role; Antioxidants, coloring agents, flavours, emulsifiers, curating agents, non-curative sweeteners, flour improvers, leavening agents, stabilizers, thickeners and preservatives.</p>	<b>10</b>
<b>Unit-IV</b>	<p><b>Glass and Refractory materials:</b> Raw materials, Soda glass, borosilicate glass, Lead Glass, Colored Glass, Refractory: Raw materials, clay pots, Zeolites.</p>	<b>10</b>

**Recommended Books:**

1. M. B. Green, G. S. Hartley West: Chemicals for Crop Protection and Pest Management, Pergamon.
2. K.H. Buchel: Chemistry of Pesticides.
3. H.B. Scher: Advances in pesticides formulation Technology (ACS)
4. Beech: Fiber reactive Dyes (Logos Press).
5. Frig and David – Dyes intermediate.
6. Allan: Color Chemistry
7. Kent-Riegels: Industries Chemistry.
8. M Ash & I Ash: A formulary of paints & other coatings.
9. L. W. Aurand, A. E. Woods, Food Chemistry, AVI Publishing Inc.
10. John M. deMan, Principles of Food Chemistry.
11. C.K. Sharma: Industrial Chemistry, Goel Publishing House, Meerut, 2011

**M.Sc. III Semester**  
**Paper-IV Unit Operation and process utilities**  
**(Paper Code- B190304T) Credit-5**

<b>Unit-I</b>	<p><b>A. Nitration:</b> Nitrating agents, Kinetics and mechanism of nitration of aromatic compounds, Nitration of paraffinic hydrocarbons, Nitrate esters, N-nitro compounds, Process equipment, Typical industrial manufacturing processes.</p> <p><b>B. Sulphonation:</b> Sulphonating agents, Kinetics and mechanism. Desulphonation Workup procedures. Industrial equipment and technique, Batch and continuous processes, Manufacturing processes for detergents, dye intermediates, turky red oil etc.</p>	<b>10</b>
<b>Unit-II</b>	<p><b>A. Halogenation:</b> Survey of methods, Catalytic chlorination, photohalogenation, Manufacturing processes for chlorohenzene, BHC, chloral.</p> <p><b>B. Esterification:</b> Esterification of carboxylic acid derivatives, Esters by addition to unsaturated systems, Industrial esterifications, Ethyl acetate, Vinyl acetate, methyl methacrylate, Cellulose acetate.</p>	<b>10</b>
<b>Unit-III</b>	<p><b>A. Amination by reduction and ammonolysis:</b> Methods of reduction to give amino compounds, Aminating Agents, Manufacture of amino compounds by reduction as well as by Ammonoloysis.</p> <p><b>B. Hydrogenation:</b> Catalytic hydrogenation and hydrogenolysis, Different types of catalysts, Hydrogenation equipment, Industrial hydrogenation processes.</p>	<b>10</b>
<b>Unit-IV</b>	<p><b>A. Petrochemicals:</b> petroleum refining, outline of chemicals derived from ethylene, xylene and naphalene.</p> <p><b>B. Oxidation:</b> Oxidising agents with typical applications of each, Liquid phase oxidation with oxidising compounds.</p> <p><b>C. Hydrolysis:</b> Manufacture of soap, fatty acids, Ethanol, glycerol and phenol.</p>	<b>10</b>

**Recommended Books:**

1. P. H. Groggins: Unit Processes in Organic Synthesis (MGH)
2. F. A. Henglein: Chemical Technology (Pergamon)
3. M. G. Rao and M. Sittings: Outlines of Chemical Technology (EWP)
4. Clausen, Mattson: Principles of Industrial Chemistry
5. H A. Lowenheim and M. K. Moran: Industrial Chemicals
6. Kirk and Othmer: Encyclopedia of Chemical technology.
7. Kent, Riegel's Industrial Chemistry (N-R).
8. S. D. Shukla and G. N. Pandey: A Textbook of Chemical Technology, Vol-II
9. J. K Stille: Industrial Organic Chemistry (P.I I.).



**M.Sc. III Semester**

**Practicals**

**(Paper Code- B190305P) Credit-4**

<b>Unit-I</b>	<p><b>Inorganic Chemistry</b></p> <p>1- <b>Preparation of selective inorganic complex (any one)</b></p> <ol style="list-style-type: none"> <li>Prussian Blue</li> <li>Ion exchange separation of oxidation state of V.</li> <li>Preparation of Fe (II) Chloride.</li> <li>Ferrocene</li> <li>Copper glycine Complex</li> </ol> <p>2- Any one analysis from the followings:</p> <ol style="list-style-type: none"> <li>Determine the capacity of <b>cation exchange resin</b> of given sample of cation exchange resin in terms of milliequivalent/g of dry resin.</li> <li>Determine the capacity of <b>anion exchange resin</b> of given sample of anion exchange in terms of milliequivalent/g of dry resin.</li> <li>Prepare <b>Copper Ferrite (CuFe<sub>2</sub>O<sub>4</sub>)</b> &amp; Find out percentage practical yield of the Copper Ferrite (CuFe<sub>2</sub>O<sub>4</sub>).</li> <li>To prepare <b>potash alum</b> &amp; find out the percentage of <b>Aluminium</b> in the alum.</li> <li>Determine the concentration in mg/lit of sulphate ion in the given sample of water nephelometrically.</li> </ol>	<b>15</b>
<b>Unit-II</b>	<p><b>Organic Chemistry</b></p> <p>1- TLC- Separation of Organic Compounds.</p> <p>2-Organic Analysis: (Any one)</p> <ol style="list-style-type: none"> <li>Estimation of Phenol and Aniline by KBr/KBrO<sub>3</sub> method.</li> <li>Estimation of Amino group.</li> <li>Estimation of Hydroxyl group.</li> <li>Estimation of Carbonyl group.</li> <li>Estimation of Reducing and non-reducing sugars.</li> </ol>	<b>15</b>
<b>Unit-III</b>	<p><b>Physical Chemistry (Any two):</b></p> <ol style="list-style-type: none"> <li>Fluorimetry: To determine the amount of riboflavin in given B-complex tablet.</li> <li>Latent Heat of fusion: To determine the latent heat of fusion of given solid.</li> <li>Polarography: Study the effect of Oxygen supporting electrolyte and maximum suppressor and determine the half wave potential of Cd/Zn in given solution by Half wave potential method. Differential method and half wave equation method.</li> <li>Potentiometry: To determine the dissociation constant of dibasic acid by potentiometric method.</li> <li>pH – metry: To determine the dissociation constant of dibasic acid pH – metrically.</li> <li>pH – metry: To determine pH value of various buffer using pH meter and determination of dissociation constant of acetic acid.</li> <li>Photometric titration</li> </ol>	<b>10</b>

## M.Sc. IV Semester

### Paper-I\_Chemistry in Industrial Processes-II

(Paper Code- B190401T) Credit-5

<b>Unit-I</b>	<b>Distillation:</b> Boiling and distillation, vapor-liquid equilibria, azeotropic mixtures, flash distillation, steam distillation, vacuum distillation and fractional distillation. <b>Extractions:</b> Extraction with reflux, Extraction with agitation, equipment, it's use and performance, continuous contact equipment, agitator extractors and packed spray extractors.	<b>10</b>
<b>Unit-II</b>	<b>Filtration:</b> Classification of filters, Sand filters, filter press, plates & frame press. <b>Flow of Heat:</b> Introduction, Conduction, Convection and Radiation. <b>Heat Exchange Equipments:</b> Introduction, Double Pipe, Shell & tube, Fixed tube and U tube heat exchangers.	<b>10</b>
<b>Unit-III</b>	<b>Crystallization:</b> Growth of Crystal, saturation, supersaturation, Classification of crystallizers and Agitated tank. <b>Drying:</b> General Principles, Rate of drying, Drying equipments, Tray dryers, Rotary dryers, Single Drum dryer & Spray dryers.	<b>10</b>
<b>Unit-IV</b>	<b>Evaporation:</b> Types of evaporators, jacketed, horizontal and vertical tube evaporators. <b>Gas Absorption:</b> Definition, examples, comparison of absorption and distillation, Packed columns and plate columns.	<b>10</b>

#### Recommended Books:

1. F. A. Henglein: Chemical Technology (Pergamon).
2. J. M. Coulson, J. F. Richardson: Chemical Engineering, Vol. I, II, III (Pergamon).
3. R.N. Shrove: The Chemical Process Industries (MGH).
4. W.L. Badger and J.T. Bandchero: Introduction to Chemical Engineering (MGH).
5. O.A. Hougen, K.M. Watson and R.A. Rargetz: Chemical Process Principles, Vol. I, II (JW).
6. P.H. Groggins: Unit Processes in Organic Synthesis (MGH)
7. G.H. Morrison & H. Freiser: Solvent extraction in Analytical Chemistry (John Wiley)
8. K.A. Gavhane: Unit operations II (Nirali Prakashan, Pune)

## M.Sc. IV Semester

### Paper-II Water Management and Industrial Pollution

(Paper Code- B190402T) Credit-5

<b>Unit-I</b>	<b>Properties of water:</b> Introduction, chemistry, uses, sources and quality of water, water for industry, water in human body, effect of water on rocks and minerals, organic, humic and colloidal matter in water. Water pollutants. Ground water pollution and its protection, Surface, river, sea and lake water pollution, Sewage, domestic, agricultural thermal, radioactive, industrial pollutants and siltation.	<b>10</b>
<b>Unit-II</b>	<b>Water Management:</b> Introduction, use and conservation of water resources, water quality management, rainwater harvesting, water management in agriculture rain fed systems, irrigated systems, industries, Sea water for agriculture, Effect of toxic metals, fertilizers, detergents and pesticides.	<b>10</b>
<b>Unit-III</b>	<b>Purification of water:</b> portability of water, removal of coarse, dispersed and colloidal impurities, clarification and coagulation of water, determination of hardness, Flocculants, Sterlization (Chemical and physical methods) fluoridation, defluoridation and disinfection of water, softening of water (Clark's, lime soda, modified lime soda, Permutit and ion exchange process) Demineralization, desalting (electro dialysis and reverse osmosis methods) and deoxygenation of water.	<b>10</b>
<b>Unit-IV</b>	<b>Prevention and analysis of water pollution:</b> Prevention, control of water pollution and its best use, Chemical and physical examination and measurement of quality of water, Chlorine demand. Analysis of calcium, magnesium, iron, manganese, silver and zinc in water. Determination of nitrate, nitrite, sulphate, chloride and fluoride. Determination of arsenic, chromium, lead, and mercury.	<b>10</b>

#### **Recommended Books:**

1. F. A. Henglein: Chemical safety Management and Engineering (Pergamon).
2. B. K. Sharma, Environment Chemistry.
3. M. K. Hill; Understanding Environmental Pollution A Primer, Cambridge University Press, 2004.
4. I. L. Pepper, C. P. Gerba, M. L. Brusseau, Environmental & Pollution Science, Elsevier, 2006.
5. G. M. Masters, Introduction to Environmental Engineering and Science, Perason, 2004.

**Note: III and IV Papers are selected from the following four papers.**

# Paper E1- Pharmaceutical Chemistry

(Paper Code- B190403T) Credit-5

<b>Unit-I</b>	<b>Drug Design:</b> Development of new drugs, procedures followed in drug design, concepts of lead compound and lead modification, concepts of prodrugs and soft drugs, structureactivity relationship (SAR), factors affecting bioactivity, resonance, inductive effect, isosterism, non-isosterism, special considerations. <b>Theories of drug activity:</b> occupancy theory, rate theory, induced fit theory. Quantitative structure activity relationship. History and development of QSAR.	<b>10</b>
<b>Unit-II</b>	<b>Pharmacokinetics:</b> Introduction to drug absorption, disposition, elimination using pharmacokinetics, important pharmacokinetic parameters in defining drug disposition and in therapeutics. Mention of uses of pharmacokinetics in drug development process. <b>Pharmacodynamics:</b> Introduction, elementary treatment of enzyme stimulation, enzyme inhibition, sulphonamides, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry.	<b>10</b>
<b>Unit-III</b>	<b>Cardiovascular Drugs:</b> Introduction, cardiovascular diseases, drug inhibitors of peripheral sympathetic function, central intervention of cardiovascular output, Direct acting arteriolar dilators, Synthesis of amyl nitrate, sorbitrate, quinidine and methyl dopa. <b>Local Anti-infective Drugs:</b> Introduction, Synthesis of sulphonamides, ciprofloxacin, norfloxacin and chloroquin.	<b>10</b>
<b>Unit-IV</b>	<b>Psychoactive Drugs- The Chemotherapy of Mind:</b> Introduction, neurotransmitters, CNS depressants, general anaesthetics, mode of action of hypnotics, sedatives, anti-anxiety drugs, benzodiazepines, buspirone, neurochemistry, of mental diseases. Antipsychotic drugs- the neuroleptics, antidepressants, butyrophenones, serendipity and drug development, stereochemical aspects of psychotropic drugs, Synthesis of diazepam, chlorazepam, alprazolam, phenytoin, ethosuximide, trimethadione, barbiturates, thiopental sodium, glutethimide. <b>Antibiotics:</b> Introduction, Synthesis of penicillin G, ampicillin, amoxicillin, tetracycline and streptomycin.	<b>10</b>

## Recommended Books:

1. Introduction to medicinal chemistry, A Gringuage, Wiley- VCH.
2. Wilson Gisvold's Text book of organic Medicinal and pharmaceutical Chemistry, Ed., Robert F. Dorje.
3. An introduction to drug design, S. S. Pandeya and J. R. Dimmock, New age International.
4. Burger's Medicinal Chemistry and Drug Discovery Volume 1 (Chap. 9 and Chap.14), Ed., M.E. Wolff, John Wiley.
5. Goodman and Gilman's Pharmacological Basis of Therapeutics, Mc Graw-Hill.
6. The organic Chemistry of Drug Design and drug action, R.B. Silverman, Academic press.
7. Strategies for Organic Drug synthesis and Design, D. Lednicer, John Wiley.

## Paper E<sub>2</sub> Polymers

(Paper Code- B190404T) Credit-5

<b>Unit-I</b>	<b>TYPES OF POLYMERS AND POLYMERISATION:</b> Thermoplastics and thermosetting, functionality concept, Concept of cross-linking-linear, Branched and cross-linked polymers. Addition, Condensation, Ionic, Co-ordination, Addition-Polymerisation Mechanism (Initiation, propagation and termination processes), Initiators, Inhibitors, Mechanism of Ionic polymerization.	<b>10</b>
<b>Unit-II</b>	<b>PROPERTIES OF POLYMERS:</b> Viscosity, Solubility, Optical, Electrical, Thermal and mechanical properties of polymers. <b>POLYMER PROCESSING:</b> Compression, Moulding, casting, Extrusion, Fibre spinning, Injection moulding, Thermoforming, Vulcanisation of elastomers.	<b>10</b>
<b>Unit-III</b>	Degradation of polymers by thermal, oxidative, Mechanical and chemical methods. Detailed study of the following thermosetting polymers with respect to synthesis, Chemical properties and applications: (i) Phenol formaldehyde resins. (ii) Amino resins- urea-formaldehyde and melamine-formaldehyde reaction, polyurethanes. (iii) Polycarbonates and silicones. (iv) Elastomers- polyisoprene, Neoprene.	<b>10</b>
<b>Unit-IV</b>	Detailed study of the following thermoplastic polymers with respect to synthesis, chemistry, properties and applications: (i) Polyolefins- Polyethylenes, (ii) Polyvinyl Chlorides- PVC, Teflon. (iii) Polyamines- Nylon-6, Nylon-66. (iv) Polyethers and polyesters- Terephthalates.	<b>10</b>

### Recommended Books:

1. Billmeyer, Textbook of polymer science, John Wiley and sons.
2. D.D. Deshpande, Physical Chemistry of macromolecules, Vishal Publications, New Delhi, 1985.
3. Polymer Science, V.R. Gowarikar, N.V. Vishwanathan and J. Sreedhan, Wiley Eastern Ltd., 1986.

# Paper E<sub>3</sub> Chemistry of materials

(Paper Code- B190405T) Credit-5

<b>Unit-I</b>	<b>A- Multiphase Materials:</b> Ferrous alloys: Fe-C phase transformation in ferrous alloys: stainless steels, non-ferrous alloys, properties of ferrous and non-ferrous alloys and their applications. <b>B- Glasses, Ceramics, Composites and nanomaterials:</b> Glassy state, glass formers and glass modifiers, applications. Ceramic structures, mechanical properties, clay products. Refractories, characterizations, properties and application.	<b>10</b>
<b>Unit-II</b>	<b>Liquid Crystals</b> mesomorphic behaviour, thermotropic liquid crystals, positional order, bond orientational order, nematic and smectic mesophases; smectic-nematic transition and clearing temperature-homeotropic, planar and schlieren textures, twisted nematics, chiral nematics, molecular arrangement in smectic A and smectic C phases, optical properties of liquid crystals.	<b>10</b>
<b>Unit-III</b>	<b>Ionic Conductors:</b> Types of ionic conductors, mechanism of ionic conduction, interstitial jumps (Frenkel). Vacancy mechanism, diffusion superionic conductors. phase transitions and mechanism of conduction in superionic conductors examples and applications of ionic conductors	<b>10</b>
<b>Unit-IV</b>	<b>Materials for solid State Devices:</b> Rectifiers, transistors, capacitors-IV - V compounds, low-dimensional quantum structures; optical properties. Conducting organics, organic superconductors, magnetism in organic materials.	<b>10</b>

### Recommended Books:

1. Material Science and Engineering. An Introduction. W.D. Callister. Wiley.
2. Material Science, J.C. Anderson, K.D. Leaver, J.M. Alexander and RD. Rawlings, ELBS.
3. Thermotropic Liquid Crystals Ed. G.W. Gray. John Wiley.
4. Handbook of Liquid Crystals. Kelker and Hafz. Chemie Verlag.

**Paper E<sub>4</sub> Organic Synthesis-II**  
**(Paper Code- B190406T) Credit-5**

<b>Unit-I</b>	<b>Organometallic reagents</b> Principles, preparations, properties and applications of the following in organic synthesis with mechanistic details. <b>A.</b> Group I and II metal organic compounds Li & Mg <b>B.</b> Transition metals Fe, Co and Ni,	<b>10</b>
<b>Unit-II</b>	<b>A-Oxidation</b> Introduction different oxidative processes. Hydrocarbons-alkenes, aromatic rings and Alcohols. <b>B- Reduction</b> Introduction, different reductive processes. Hydrocarbons-alkanes, alkynes, aromatic rings, aldehydes and ketones.	<b>10</b>
<b>Unit-III</b>	<b>Rearrangements</b> Synthesis- Neber, Beckmann, Curtius, Schmidt and Baeyer-Villiger.	<b>10</b>
<b>Unit-IV</b>	<b>Metalloenes, Nonbenzenoid Aromatic and polycyclic aromatic compounds</b> General consideration, synthesis and reactions of some representative compounds.	<b>10</b>

**Books suggested**

1. Modern synthetic reactions, H.O. House, W.A. Benjamin.
2. Some modern methods of organic synthesis, W. Carruthers, Cambridge Univ. Press.
3. Advanced organic chemistry, reactions mechanisms and structure, J. March, John Wiley.
4. Principles of organic synthesis, R.O.C. Norman and J.M. Coxon, Blackie academic and professional.
5. Advanced organic chemistry part B, F.A. Carey and R.J. Sundberg. Plenum Press.
6. Rodd's chemistry of carbon compounds, Ed. S. Coffey Elsevier.
1. Designing organic synthesis, S. Warren, Wiley.
2. Organic synthesis-concept, methods and starting materials, J. Fuhrhop and G. Penzillin, verlage VCH.
3. Some modern methods of organic synthesis, W. Carruthers, Cambridge Univ. Press.
4. Modern synthetic reactions, H.O. House, W.A. Benjamin.
5. Advanced organic chemistry: reactions mechanism and structure, J. March, Wiley.
6. Principles of organic synthesis, R. Norman, J.M. Coxon, Blackie academic and professional.
7. Advanced organic chemistry part B. F.A. Carey and R.J. Sundberg, Plenum press.

## M.Sc.IV Semester

### Practicals

#### M.Sc. (Paper Code- B190407 P) Credit-4

<b>Unit-I</b>	Preparation: (one from each) a. Dye: Eosin, Fluorescence b. Drugs: Paracetamol, Aspirin, Urotropine, Oil of Wintergreen. c. Fragrance: Oil of Nerol. d. Soap: Simple soap.	<b>10</b>
<b>Unit-II</b>	Determinations: a. Vitamin C in citrus fruit juice. b. Total reducing sugar Lane & Eynon method. c. Pectin content guava fruit. d. Hg in air, water, and fish.	<b>10</b>
<b>Unit-III</b>	Extraction: a. Casein from milk. b. Citral from lemon grass. c. Caffeine from tea leaves. d. Eugenol from clove.	<b>10</b>
<b>Unit-IV</b>	Analysis a. acid value and iodine value of in given fat/oil. b. percentage of acetic acid in a sample of vinegar. c. purity of commercial benzoid by IR. d. identification of drugs by TLC.	<b>10</b>

