

BCY-01		ENGINEERING CHEMISTRY	
Course category	:	Basic Sciences & Maths (BSM)	
Pre-requisites	:	NIL	
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 2	
Number of Credits	:	5	
Course Assessment methods	:	Continuous assessment through tutorials, assignments, quizzes and Three Minor tests and One Major Theory & Practical Examination	
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course	
<ol style="list-style-type: none"> 1. Students will acquire basic knowledge in Engineering Chemistry, which allows students to gain qualitative and quantitative skills. 2. Make good scientific observations and develop experimental method of evaluation of different systems at industrial or research level. 3. Students will develop Interdisciplinary skills which can help them to thrive in the life-long changing environment in various fields of Industry. 4. Students will acquire practical knowledge and will be able to analyze data constructively and formulate new ideas. 			
Topics Covered			
UNIT-I			9
Molecular orbital theory, LCAO approximation, MO diagrams of diatomic molecules. Band theory of metallic bond, Hydrogen bonding, Structure of graphite and fullerene- C ₆₀ , Liquid crystallite state, classification and applications of liquid crystals, Types of unit cell, space lattice (only cubes), Bragg's Law, Calculation and density of the cubic unit cell, Phase Rule and its application to water system.			
UNIT-II			9
Inductive, mesomeric and hyperconjugative effects, Stability of reactive intermediates, e.g. Carbocation, Carbanion and free radicals, Types of organic reactions, & Mechanism of nucleophilic substitution & elimination reactions, Mechanism of organic name reactions (Cannizzaro reaction, Aldol condensation, Beckmann rearrangement, Hoffmann rearrangement & Diels Alder Reaction) Stereosomerism of organic compounds containing one & two chiral centers. Enantiomers & diastereomers, R-S & E-Z Nomenclature, Examples of optically active compounds without chiral centre, Conformations of butane			
UNIT-III			9
Introduction & classification of polymers, Chain and Step growth polymerization, Thermoplastic and Thermosetting resins, Elastomers and synthetic fibres, Mechanism of chain polymerization, Stereoregular polymers, Synthesis and applications of: Polyethylene, Poly propylene, PVC, PMMA, PAN, PET, Polyamides, Polyurethane, Natural and synthetic Rubbers, Phenol Formaldehyde Resin. Conducting & biodegradable polymers and their applications Cement and its applications Classification of Fuels, calorific value of fuel, gross & net calorific value, determination of calorific value using Bomb calorimeter			
UNIT-IV			9
Basic principles of spectroscopic methods, Basic principles of UV-Visible, IR, ¹ H NMR & Mass spectroscopy, determination of structure of simple organic compounds. Hardness of water, Softening of water (Zeolite process, Lime Soda process & Ion exchange process). Treatment of boiler feed water by Calgon process			

EXPERIMENTS

1. Determination of iron content in the given sample using $K_3[Fe(CN)_6]$ as an external indicator.
2. Determination of temporary and permanent hardness in water sample using EDTA as standard solution.
3. Determination of alkalinity in the given water sample.
4. Determination of chloride content in the given water sample by Mohr's method.
5. Determination of percentage of available chlorine in bleaching powder sample.
6. pH-metric titration between strong acid and strong base.
7. Viscosity of a polymer like polystyrene by Viscometric method.
8. Element detection & functional group identification in organic compounds
9. Preparation of a polymer like Bakelite or PMMA.
10. Preparation of Sodium Cobaltinitrite salt.

Books & References

1. Engineering Chemistry, Wiley India
2. Engineering Chemistry, Tata McGraw Hill
3. Concise Inorganic Chemistry - J.D. Lee; Wiley India
4. Organic Chemistry- Morrison & Boyd, 6th edition, Pearson Education
5. Physical Chemistry - Gordon M. Barrow; McGraw Hill
6. Physical Chemistry - Peter Atkins & Julio De Paula, Oxford University Press

BCY-02	APPLIED ENGINEERING CHEMISTRY	
Course category	:	Basic Sciences & Maths (BSM)
Pre-requisites	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 2
Number of Credits	:	5
Course Assessment methods	:	Continuous assessment through tutorials, assignments, quizzes and Three Minor tests and One Major Theory & Practical Examination
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course
<ol style="list-style-type: none"> 1. Students will acquire basic knowledge in Engineering Chemistry, which allows students to gain qualitative and quantitative skills. 2. Make good scientific observations and develop experimental method of evaluation of different systems at industrial or research level. 3. Students will develop Interdisciplinary skills which can help them to thrive in the life-long changing environment in various fields of Industry. 4. Students will acquire practical knowledge and will be able to analyze data constructively and formulate new ideas. 		
Topics Covered		
UNIT-I		9
<p>Thermodynamics I: First Law of thermodynamics and internal energy, state and state functions, sign convention for heat and work, nature of work, path dependence of heat and work. Enthalpy, heat changes at constant volume and constant pressure, heat capacities (CV, CP) and their relationship for ideal gases.</p> <p>Change in internal energy (ΔU) and enthalpy (ΔH) of chemical reactions, relation between ΔU and ΔH, variation of heat of reaction with temperature (Kirchhoff's equation).</p> <p>Thermodynamics II: Second Law of Thermodynamics, Carnot cycle, entropy, entropy changes in reversible and irreversible processes and of universe.</p> <p>Electrochemistry: Arrhenius theory of electrolytic dissociation, Hydrolysis of salts, hydrolysis constant, buffer solutions, indicators and theory of acid-base indicators.</p>		
UNIT-II		9
<p>Electrochemical Cells: Reactions in reversible cells, free energy and emf of reversible cell. Single electrode potential (Nernst equation), its measurement and sign convention. Standard electrode potential. Emf of reversible cell from electrode potentials. Types of reversible electrode, reference electrodes. Applications of emf measurements: pH, and equilibrium constant. Potentiometric titration.</p> <p>Corrosion: Causes of metallic corrosion, types of corrosion, measurements of corrosion by weight loss method, prevention (electrochemical and inhibitor).</p> <p>Chemical Kinetics: Order and molecularity of chemical reactions, pseudo order and first order. Kinetic law for second order reactions, determination of the rate constant and order of reaction from kinetic data. Effect of temperature on rate of reaction, Arrhenius equation.</p>		

UNIT-III	9
<p>Basic concepts of organic reactions. Types of organic reactions (Addition, substitution, elimination and rearrangement reactions)</p> <p>Electrophilic Substitution, Mechanism of nitration, halogenation, sulphonation, and Friedel-Crafts (alkylation and acylation) reactions. Effects of substituents on orientation and reactivity.</p> <p>Addition reactions, Hydration, hydroxylation, and hydroboration of alkenes.</p>	
UNIT-IV	9
<p>Coordination compounds: Nomenclature, Werner's theory. Isomerism. Sidgwick's EAN concept and Valence Bond Theory. Stereochemistry of coordination compounds with coordination no. 4, 5 and 6.</p> <p>Theories of Metal-Ligand bonding: Limitations of valence bond theory; Crystal-field theory and crystal-field splitting in octahedral, tetrahedral and square planar complexes. Factors affecting the crystal-field splitting.</p>	
EXPERIMENTS	
<ol style="list-style-type: none"> 1. Determination of the coefficient of viscosity of the given unknown liquids using Viscometer and identify the given liquid. 2. Study of the distribution of iodine between water and CHCl_3 / butanol. 3. Determination of the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature. 4. Determination of the strength of NaOH solution with the help of oxalic acid. 5. Preparation of inorganic complex of copper/ nickel. 6. Preparation of polyacrylic acid by free radical polymerization. 7. Determination of R_f value by paper chromatography. 8. Determination of Surface Tension of a given liquid by Stalagamometer. 9. Preparation of iodoform from acetone. 10. Applications of TLC in the organic chemistry. 	
Textbooks & Reference books	
<ol style="list-style-type: none"> 1. <i>Engineering Chemistry</i>, Wiley India 2. <i>Engineering chemistry</i> by Sivasankar, Tata McGraw Hill, New Delhi. 3. <i>Physical Chemistry</i>, P. C. Rakshit, 5th Edition (1988), 4th Reprint (1997), Sarat Book House, Calcutta. 4. <i>Physical Chemistry</i> by Peter Atkins & Julio De Paula; Oxford University Press 5. <i>Physical Chemistry</i> by Gordon M. Barrow; McGraw Hill 6. <i>Chemical Kinetics and Reaction Dynamics</i> by S.K. Upadhyay, Springer 7. <i>Physical Chemistry</i>, K. J. Laidler and J. M. Meiser, 3rd Edition, Houghton Mifflin Comp., New York, International Edition (1999). 8. <i>Inorganic Chemistry</i>, J.E. Huheey, E.A. Keiter and R.L. Keiter, Pearson Education India, 2006. 9. <i>Concise Inorganic Chemistry</i> by J.D. Lee; Wiley India 10. <i>Guidebook to Mechanism in Organic Chemistry</i> by Peter Sykes, Orient Longman 11. <i>Organic Chemistry</i> by Morrison & Boyd; Pearson Education 12. <i>Organic Chemistry</i>, J. Clayden, N. Greeves, S. Warren, and E. Wothers, Oxford Univ. Press, Oxford (2001). 	

BCY-03	ENVIRONMENTAL CHEMISTRY	
Course category	:	Basic Sciences & Maths (BSM)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and Three Minor tests and One Major Theory Examination
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course
<ol style="list-style-type: none"> 1. Students will acquire basic knowledge about Environment , which allows students to gain qualitative and quantitative skills. 2. Students will aware of environmental pollution and control methods along with quality standards of air, water etc along with waste management. 3. Students will able to give systematic account of natural resources their use and environmental problems due to overexploitation. 4. Students will acquire basic knowledge about the chemical reactions taking place in the environment. 		
Topics Covered		
UNIT-I		9
Basic concept of Environmental chemistry, Introduction to atmospheric chemistry, Layers of the atmosphere and their chemical composition, chemistry of gaseous and particulate pollutants, , Stratospheric ozone depletion, Ozone Holes , stratospheric ozone chemistry , Fossil fuel burning, CO ₂ emissions, Greenhouse Effect Tropospheric air pollution, concept of fog and smog, Consequences of air pollution. The Human Health Effects of Outdoor Air Pollutants		
UNIT-II		9
The Chemistry of Natural Waters , Oxidation-Reduction Chemistry in Natural Waters, Ion Concentrations in Natural Waters and Drinking Water, Water Pollution and Purification of Water, Water Disinfection , Desalination of Salty Water, Groundwater: Its Supply, Chemical Contamination, and Remediation The Chemical Contamination and Treatment of Wastewater and Sewage .Management of water resources.		
UNIT-III		9
Toxic Heavy Metals, Murcury, Lead, Arsenic and chromium, Soil pollution, Domestic and Commercial Garbage: Its Disposal and Minimization. The Recycling of Household and Commercial Waste, Hazardous Wastes and methods of disposal		
UNIT-IV		9
Toxic Organic Compounds, Pesticides, Insecticides, Herbicides, Dioxins, Furans, and PCBs, Polynuclear Aromatic Hydrocarbons Chemistry of food additives, dyes, detergents and bleaching agents		
Books & References		
<ol style="list-style-type: none"> 1. Environmental Chemistry - Colin Baird and Michael Cann, W. H. Freeman 2. Environmental Chemistry - Stanley E. Manahan, CRC Press; 9th edition 		

BCY-04	ENVIRONMENT & ECOLOGY	
Course category	:	Basic Sciences & Maths (BSM)
Pre-requisites	:	NIL
Contact hours/week	:	Lecture : 2, Tutorial : 1 , Practical: 0
Number of Credits	:	3
Course Assessment methods	:	Continuous assessment through tutorials, assignments, quizzes and Three Minor tests and One Major Theory Examination
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course
<ol style="list-style-type: none"> 1. Students will acquire basic knowledge in Environment and Ecology, which allows students to gain qualitative and quantitative skills. 2. Students will aware of environmental pollution and control methods along with quality standards of air, water etc along with waste management. 3. Students will able to give systematic account of natural resources their use of exploitation and environmental 4. How to achieve sustainable development through strategies and its threats 		
Topics Covered		
UNIT-I		6
<p>The Multidisciplinary nature of environmental studies, Definition, scope and importance, Need for public awareness. Natural Resources, Renewable and non-renewable resources, Natural resources and associated problems</p> <ol style="list-style-type: none"> (a) Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining. (b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. (c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, (d) Food resources: World food problem, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. (e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. 		
UNIT-II		6
<p>Ecosystems Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids Introduction, types, characteristic features, structure and function of the following ecosystem: (a) Forest ecosystem (b) Grassland Ecosystem (c) Aquatic ecosystems (ponds, rivers, oceans)</p> <p>Biodiversity Introduction- Definition : genetic, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity: habitat loss, Endangered and endemic species of India, Conservation of biodiversity:</p>		
UNIT-III		6
<p>Environmental Pollution Causes, effects and control measures of-</p> <ol style="list-style-type: none"> (a) Air Pollution. (b) Water Pollution. (c) Soil Pollution (d) Marine Pollution. (e) Noise Pollution. (f) Thermal Pollution. <p>Solid waste Management: Causes, effects and control measures of urban and industrial wastes.</p>		

Role of an individual in prevention of pollution Global warming and green house effect, Acid Rain, Ozone Layer depletion	
UNIT-IV	6
Environmental Protection- Role of Government, Legal aspects, Initiatives by Non-governmental Organizations (NGO), Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness. Human Population and the Environment Population growth, Population explosion- Family Welfare Programme, Environment and human health, Environmental Education, Women Education., Women and Child Welfare	
Books & References	
1. Environmental Studies - J Krishnawamy , R J Ranjit Daniels, Wiley India 2. Environmental Science - Bernard J. Nebel, Richard T. Right, 9780132854467, Prentice Hall 3. Environment and Ecology - R K Khandal, 978-81-265-4277-2, Wiley India 4. Environmental Science – 8 th edition ISV, Botkin and Keller, 9788126534142, Wiley India 5. Environmental Studies - Soli. J Arceivala, Shyam, R Asolekar, McGrawHill India, 2012 6. Environmental Studies - D.L. Manjunath, 9788131709122 Pearson Education India, 2007	

BCY-05		Polymer Chemistry	
Course category	:	Basic Sciences & Maths (BSM)	
Pre-requisite Subject	:	NIL	
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0	
Number of Credits	:	4	
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor tests and One Major Theory Examination	
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course	
<ol style="list-style-type: none"> 1. Students will acquire basic knowledge in Polymer Chemistry, which allows students to gain qualitative and quantitative skills. 2. Make good scientific observations and develop experimental method of evaluation of different systems at industrial or research level. 3. Students will develop Interdisciplinary skills which can help them to thrive in the life-long changing environment in various fields of Industry. 4. Students will acquire practical knowledge and will be able to analyse data constructively and formulate new ideas. 			
Topics Covered			
UNIT-I			9
<p>Polymers: Monomers, Functionality , Classification of polymers, Structure of polymers, Chemistry of polymerization, molecular weight & polydispersity, Crystallinity and glass transition temperature(Tg) & crystallinity of polymers, Chain and step growth polymerization, mechanism of free radical, cationic, anionic and coordination polymerization, stereochemistry of polymers,</p>			
UNIT-II			9
<p>Polymerization techniques: Bulk polymerization, Solution polymerization, Suspension polymerization , Emulsion polymerization .</p> <p>Thermoplastic Polymers : polyolefins , vinyl polymers , poly vinyl chloride, polystyrene, PMMA, Polyacrylonitrile, Teflon, polyamides, polycarbonates and their applications.</p> <p>Thermosetting Polymers: Phenolic resins, Urea-formaldehyde resin, melamine-formaldehyde resin, polyesters, epoxies, bisphenol A, polyurethanes, silicone resins and their applications.</p>			
UNIT-III			9
<p>Rubbers: Natural rubber, Isoprene rubber, Synthetic rubbers , Butadiene rubber, Butyl rubber, Styrene Butadiene Rubber, Neoprene rubber, Nitrile rubber, EPDM rubber and Silicone rubber and their applications.</p> <p>Conducting polymers: Types of conducting polymers. Chemical and electrochemical routes of synthesis. Doping of conjugated polymers, Mechanism of conduction.</p> <p>Biodegradable Polymers and Natural polymers.</p>			
UNIT-IV			9
<p>Analytical Techniques:</p> <p>Thermal Analysis: Thermal transitions and their classification in polymers, glass transition temperature and its mechanism, melting point of semi crystalline polymers, characterizing polymer and polymer blends using differential thermal analysis (DTA), and differential scanning calorimeter</p>			

(DSC) techniques, thermal conductivity in polymers, crystallization, thermogravimetric analysis (TGA)

Molecular weight determination: Basic concepts of end group analysis, colligative properties, osmometry, light scattering, and gel permeation chromatography, Viscosity of polymers solutions, size of the polymer molecules.

Books & References

1. R.B. Seymour, C.E. Carraher, Polymer Chemistry, CRC Press, 7th edition, 2008, Boca Raton.
2. J R Fried, Polymer Science and technology, Prentice Hall of India New Delhi 2nd edition 2005.
3. F W Billmeyer ,Text book of Polymer Science , Willey -Inter science New York, 4th Ed. 1981.
4. B. Vollmert, Polymer Chemistry, Springer-Verlag, Berlin.
5. George Odian , “Principles of polymerisation”, Seymour Robert
6. V.R. Gowariker, “Polymer Science” – New Age International (P) Ltd, Publishers