BCY-151/152: ENGINEERING CHEMISTRY

L	T	P	C
3	0	2	4

OBJECTIVE:
The objective of this course is to make students learn the laboratory skills needed to design safe conduction of reactions and experiments in Chemistry. The student will acquire a foundation of Chemistry to enable them to understand and critically interpret the primary research in Chemistry.

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

CO1	Interpret UV-Visible and IR-Spectra	Understand, Analyze
CO2	Describe reaction rates for reactions of various orders	Understand, Apply, Analyze
CO3	Understand different aspects of corrosion andthermodynamic view of electrochemical processes, reversible, irreversible cells and nanochemistry	Understand, Apply
CO4	Understand the stereochemistry of molecules and identify organic reactions on the basis of their mechanism	Remember, Apply, Analyze
CO5	Distinguish between different polymeric structures, classify polymers, and analyze the polymerization mechanism and use of polymers in different walks of life. Knowledge of conductivity of polymer, biodegradable polymers and fibre reinforced plastics. Acquire knowledge about water and treatment of municipal water and solid waste management	Understand, Apply, Evaluate,Create
CO6	To develop experimental skills to perform, monitor and manipulate the reactions.	Understand, Evaluate, Analyze

Chemistry												
BCY151/ 152	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	3	2	-	2	-	-	-	-	3
CO2	3	3	1	3	2	-	2	-	-	-	-	3
CO3	3	3	1	3	2	-	2	-	-	-	-	3
CO4	3	3	1	3	2	-	2	-	-	-	-	3
CO5	3	3	1	3	2	-	2	-	-	-	-	3
CO6	3	3	3	3	2	2	2	2	1	2	-	3
Average	3	3	1.3	3	2	0.33	2	0.33	0.16	0.33	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation put "-".

SYLLABUS

Module I

(i) ***Bonding***: VSEPR Theory, Valence Bond Theory, Crystal-field theory, Electronic Spectra and Ligands (strong and weak field), Phosphorescence and Fluorescence, Jablonski diagram, hydrogen

bonding and their effect on physical properties, Metallic bonds, Classification and Applications of Liquid crystals, Band Theory of Solids and superconductors.

(ii) ***Spectroscopy***: Basic Principles, Instrumentation and Applications of UV-Vis and IR Spectroscopy. (Lectures: 6-7)

(Lectures: 5-6)

Module II

(i) ***Chemical Kinetics***: Second order reactions. Determination of order, Fast and slow reaction, steady state approximation, Temperature effect, Concept of Activated Complex/Transition State: Energy ofactivation, Potential energy surface, Theories of reaction rate: Collision and Transition State theories interms of enzyme catalysis. (Lectures: 4-5)

(ii) ***Surface Chemistry***: Introduction, Types of adsorption, Adsorption isotherms, BET, Applications of adsorption. (Lectures: 2-3)

Module III

(i) ***Electrochemistry***: Dry and fuel cells, electrochemical cell, Solar cells, Disensitized cell, Photovoltaiccell. (Lectures: 3-4)

(ii) ***Nanochemistry:*** Introduction, general methods of synthesis, classification and applications of nano materials. (Lectures: 2)

(iii) ***Environmental Chemistry*:** Air and Water Pollution, analysis of gaseous effluents oxides of Nitrogen, oxides of Sulphur and H_2S, chemical analysis of effluents liquid streams, BOD, COD, control of pollution, Depletion of ozone layer. (Lectures: 5-6)

Module IV

(i) ***Stereochemistry*:** Stereoisomerism of organic compounds containing one & two chiral centers. Enantiomers & Diastereomers, E-Z nomenclature, R-S configuration, Atropisomerism, and Optical isomerism in Allenes, biphenyl and Spiranes, Circular Dichroism.

(Lectures: 5-6)

(ii) ***Reaction Mechanism***: Inductive, Electromeric and Mesomeric effects. Study of reaction intermediates (Carbanion, carbocation, carbene, nitrene and benzyne). Mechanism of nucleophilic and electrophilic substitution reactions. Mechanism and application of following reactions:

a) Suzuki-Miyaura Cross coupling reaction
b) Fries and Photo-Fries Rearrangement
c) Wagner-Meerwein Rearrangement
d) Umpolung Reactions
e) Favorskii Rearrangement

(Lectures: 5-6)

Module V

(i) ***Polymers***: Introduction, types of polymers, Molecular mass-number and mass average molecular weight, determination of molecular mass by Osmometry, viscosity, light scattering and size exclusion chromatography, Rheological properties and uses of some common polymers. Synthetic Polymers (carbon framework, silicon framework, fluorinated polymer), Conducting and Biodegradable polymers. (Lectures: 4-5)

(ii) ***Water Analysis*:** Introduction; Hardness of Water- cause, types, units, Disadvantages of using hard water for domestic and industrial purposes, Softening of hard water, Chemical analysis of Water- estimation of free chlorine, total alkalinity, hardness, Numerical based on determination of hardness. (Lectures: 4-5)

(iii) ***Solid Waste Management***: Classification, waste treatment & Disposal methods (Composting, sanitary landfilling, thermal processes, recycling and reuse). (Lectures: 4-5)

List of Experiments:

1. Determination of alkalinity in given water sample.
   a. Sodium Carbonate & Sodium Bicarbonate
   b. Sodium Carbonate & Sodium Hydroxide
2. Determination of temporary and permanent hardness in water sample using EDTA as standardsolution.
3. Determination of Chloride content of water by Mohr's Method.
4. Determination of Chlorine content in Bleaching powder.
5. Determination of strength of supplied Ferrous Ammonium Sulphate (FAS) solution in usingexternal, internal indicators.
6. Determination of viscosity of a given liquid by Ostwald's viscometer.
7. Determination of surface tension of a given liquid by Stalagmometer.
8. Determination of end point in acid base titration using pH metric method.
9. Determination of Dissociation constant of weak acids by conductometric Titration.
10. To prepare aspirin (acetyl salicylic acid) from salicylic acid.
11. Synthesis of polyurethane.
12. Find the concentration of the given samples using visible spectroscopy.

Reference Books:

1. Engineering Chemistry by Shashi Chawla, Publisher: Dhanpat Rai & Co.
2. Organic Chemistry by I. L.Finar, Publisher: Longman
3. Physical Chemistry by Puri, Sharma & Pathania, Publisher: Vishal Publishing
4. Polymer Science by V. R. Gowarikar, N. V. Vishwanathan and J. Shridhar, Publisher: Wiley Eastern Ltd.,New Delhi.
5. Elementary Organic Spectroscopy by Y.R. Sharma, Publisher · S Chand & Co Ltd.

Evaluation Scheme:

S. No.	Course Type	Subject Code	Course title	Credits	L T P	Sessional Marks				ESM	Total Marks
						MSE	TA	Lab	Total		
1	BSC	BCY 151/152	Engineering Chemistry	4	3 0 2	15	20	15	50	50	100

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