

LOK JAGRUTI UNIVERSITY (LJU)
INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of Chemical Engineering (708)

Bachelor of Engineering (B.E.) - Semester – II

Course Code:	017081201
Course Name:	Chemistry - II
Category of Course:	Basic Science course (BSC)
Prerequisite Course:	Chemistry- I (017081101)

Teaching Scheme				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Total Hours
5	0	2	6	50

Syllabus				
Unit No.	Topic/	Prerequisite Topic	Successive Topic	Teaching Hours
01	Introduction to Chemical bonding			5 (10%)
	1.1 Types of Bonds	---	Concept of Radiation (017083403-Unit-6.1)	
	1.2 Formation of molecules – Kossel – Lewis approach to Chemical Bonding	Types of Bonds (017081201-Unit-1.1)		
	1.3 MO theory	---		
1.4 Coordination numbers and geometries of molecules	Types of Bonds (017081201-Unit-1.1)			
02	Periodic Properties			4 (8%)
	2.1 Introduction	---	---	
	2.2 Ionization energies, electron affinity	Types of Bonds (017081201-Unit-1.1)		
	2.3 Electronegativity, polarizability	---		
	2.4 Oxidation states	---		
03	Analytical Techniques and Applications-I			6 (12%)
	3.1 Spectroscopic Techniques: Principles of Spectroscopy	---	Analysis of air pollutants (017083404-Unit-4.3)	
	3.2 UV-Visible Spectroscopy and its Application	Spectroscopic Techniques: Principles of Spectroscopy (017081201-Unit-3.1)		
	3.3 Vibrational and Rotational spectroscopy (IR) and its Application	Spectroscopic Techniques: Principles of Spectroscopy (017081201-Unit-3.1)		
	3.4 NMR spectroscopy	Spectroscopic Techniques: Principles of Spectroscopy (017081201-Unit-3.1)		
	3.5 Gas chromatography	---		
	3.6 HPLC	---		
04	Analytical Techniques and Applications-II			7 (14%)
	4.1 Surface Characterization Techniques	---	Analysis of air pollutants (017083404-Unit-4.3)	
	4.2 Scanning Electron Microscopy(SEM) and its Applications	Surface Characterization Techniques(017081201-Unit-4.1)		
	4.3 Transmission Electron Microscopy(TEM) and its Applications	---		
	4.4 Material characterization techniques: XRD	---		
	4.5 Differential Thermal Analysis (DTA) and their applications	---		
	4.6 Mass Spectrometry	---		
05	Water Technology			5 (10%)
	5.1 Introduction	---	Demineralization, Deionization, Desalination, Reverse osmosis (017083304-Unit-2.3)	
	5.2 Sources of water, Impurities in water, Hardness of Water	---		
	5.3 Softening of water (External & Internal treatments)	Sources of water, Impurities in water, Hardness of Water (017081201-Unit-5.2)		
06	Nano Chemistry			5 (10%)
	6.1 Introduction to nanoparticles	---	---	
	6.2 Sources, types of nanomaterials	Introduction to nanoparticles (017081201-Unit-6.1)		
	6.3 Synthesis: Top down and Bottom up approaches	---		
	6.4 Nano electronics, Nano medicines	---		
07	Petroleum Chemistry			5 (10%)
	7.1 Types of fuel and their applications	---	Physical Impurities found in Crude and their Removal (017083602 - Unit-4.3)	
	7.2 Calorific Value, Characteristics of good fuel	Types of fuel and their applications (017081201-Unit-7.1)		
	7.3 Analysis of coal – ultimate and proximate analysis	---		
	7.4 Refining of Petroleum by Fractional distillation	---		
08	Polymer Chemistry			5 (10%)
	8.1 Introduction and Classification of polymers	---	---	

	8.2 Polymerization and its mechanism	Introduction and Classification of polymers (017081201-Unit-8.1)		
	8.3 Definition and Vulcanization of rubber	---		
	8.4 Applications of rubber	Definition and Vulcanization of rubber (017081201-Unit-8.4)		
09	Green Chemistry			4 (8%)
	9.1 Introduction	---	Atom economy, waste prevention and minimization of waste generation (017083404 -Unit 10.4)	
	9.2 Principles of Green Chemistry	---		
	9.3 Global Challenges and its solution through Green Chemistry	Principles of Green Chemistry (017081201-Unit-9.1)		
10	Biochemistry			4 (8%)
	10.1 Introduction	---	---	
	10.2 Scope, importance and application	Introduction (017081201-Unit-10.1)		
	10.3 Benefits through biotechnology – Agriculture, Food quality, Medicines,	---		

Sr No.	Practical Title	Link to Theory Syllabus
1	To determine the Concentration of Unknown Solution Spectrophotometrically	Unit 3,5
2	To identify the given sample using IR spectroscopy	Unit 3
3	Identification of given compound using HPLC	Unit 3,5
4	Identification of Pollutant through gas chromatography	Unit 3
5	To determine hardness of water using EDTA	Unit 5
6	To determine Chlorinity of given water sample	Unit 5
7	To determine alkalinity of given water sample	Unit 5
8	Proximate analysis of given coal sample	Unit 7
9	Ultimate analysis of given coal sample	Unit 7
10	Applications of Commercially important polymers	Unit 8
11	Identification of Commercially important polymers	Unit 8

Major Components/ Equipment	
Sr. No.	Component/Equipment
1	SEM
2	UV Spectrophotometer
3	DTA
4	HPLC
5	TLC
6	IR Spectrophotometer
7	Hot air oven
8	Desiccator

Proposed Theory + Practical Evaluation Scheme by Academicians (% Weightage Category Wise and it's Marks Distribution)						
L:	5	T:	0	P:	2	
Note: In Theory Group, Total 4 Test (T1+T2+T3+T4) will be conducted for each subject. Each Test will be of 25 Marks. Each Test Syllabus Weightage: Range should be 20% - 30%						
Group (Theory or Practical)	Group (Theory or Practical) Credit	Total Subject Credit	Category	% Weightage	Marks Weightage	
Theory	5	6	MCQ	58%	70	
Theory			Theory Descriptive	21%	25	
Theory			Formulas and Derivation	0%	0	
Theory			Numerical	4%	5	
Expected Theory %	83%			Calculated Theory %	83%	100
Practical	1		Individual Project	4%	25	
Practical			Group Project	4%	25	
Practical			Internal Practical Evaluation (IPE)	9%	50	
Practical			Viva	0%	0	
Practical			Seminar	0%	0	
Expected Practical %	17%		Calculated Practical %	17%	100	
Overall %	100%			100%	200	

Course Outcome	
	<i>Upon completion of the course students will be able to</i>
CO1	Understand the structure and approaches of a molecule, Chemical bonding, Periodic properties and Be familiar with spectroscopic analytical techniques commonly used in chemical analysis
CO2	Be familiar with different electron microscopy analytical techniques and water softening method
CO3	Understand the concept of Nano - Chemistry and Petroleum Chemistry
CO4	Understand the polymer chemistry, polymerization techniques, concept of green chemistry and biochemistry
Suggested Reference Books	
1	Essential of Physical Chemistry by Bahl and Tuli., S Chand & Co. Ltd, New Delhi.
2	D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch, Fundamentals of Analytical Chemistry
3	Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishing Co.
4	R.T. Morrison and R.N. Boyd, Organic Chemistry, Prentice Hall of India Pvt. Ltd., 5th edition, 1990
5	Introduction to Nano Science by N. Lindsay, Oxford University Press

List of Open Source Software/Learning Website	
1	https://nptel.ac.in
2	https://www.edx.org/course/subject/chemistry

Practical Project/Hands on Project		
Sr. No.	List of Practical Projects/Hands on Project	Linked with Unit
1	Describe in detail how MO theory plays an important role in formation of Bonds.	Unit 1
2	Explain how trends of various periodic properties plays important role in deciding behavior of an element.	Unit 2
3	Prove that NMR Spectroscopy is the age-old technique in research institutions with reasons.	Unit 3
4	Provide detail on Transmission electron microscopy and its applications in chemical industries.	Unit 4
5	Give a detail note on impurities found in water in recent times and their health effects.	Unit 5
6	Provide in detail the need of Nano electronics in nearby future with suitable examples.	Unit 6
7	There are recent advances in molecular medicine sector. How this advances are led by Nano medicine, explain using examples.	Unit 6
8	Determine the moisture content in given coal sample and prove its importance using example.	Unit 7
9	Describe the Properties of most widely used polymers in routine life and prove the link between applications and their properties.	Unit 8
10	Describe in detail Principles of Green chemistry using examples of industrial application.	Unit 9
11	Explain the importance of Genetically engineered crops in recent scenarios by stating examples.	Unit 10