

Name of Faculty	:	Faculty of Engineering & Technology
Name of Program	:	Bachelor of Technology (B. Tech)
Course Code	:	1BCH01
Course Title	:	Engineering Chemistry
Type of Course	:	Basic Science (BS)
Year of Introduction	:	2023-24

Prerequisite	:	Fundamentals of Chemistry
Course Objective	:	The course aims to provide students with a comprehensive understanding of chemical kinetics, electrochemistry, organic reaction mechanisms, spectroscopy, and nanomaterials.
Course Outcomes	:	At the end of this course, students will be able to:
	CO1	Understand the basic concepts of chemical kinetics and how to calculate reaction rates.
	CO2	Understand the basic principles of electrochemistry, including redox reactions, half-reactions, and electrode potentials.
	CO3	Understand the concept of reaction intermediates and how they relate to organic reaction mechanisms.
	CO4	Understand the basic principles of spectroscopy and the applications of UV, IR, and NMR spectroscopy in chemical analysis.
	CO5	Understand the basic principles of nanomaterials and their synthesis.

Teaching and Examination Scheme

Teaching Scheme (Contact Hours)			Credits	Examination Marks				
L	T	P		Theory Marks		Practical Marks		Total Marks
			C	SEE	CIA	SEE	CIA	
3	0	2	4	70	30	30	20	150

Legends: **L**-Lecture; **T**-Tutorial/Teacher Guided Theory Practice; **P**-Practical, **C**-Credit, **SEE**-Semester End Examination, **CIA**-Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content

Unit No.	Topics	Teaching Hours	Weightage	Mapping with CO
1	Chemical Kinematics and catalysis Introduction to rate equation and reaction order, reaction mechanism, relation between rate equation and reaction mechanism, Pseudo First order reaction,	9	20%	CO1

	First order reaction, Second order reaction, Arrhenius theory, Collision theory, Transition-state theory, Physical adsorption, Heterogenous catalysis, examples of heterogeneously catalysed reaction			
2	Electrochemistry Electrochemistry and Batteries: Basic concepts of electrochemistry. Batteries; Classification and applications of Primary Cells (Dry Cell), Secondary Cells and fuel cell Corrosion: Introduction to corrosion. Types of corrosion, Cause of corrosion, Corrosion prevention and control, Corrosion issues in specific industries (Power generation, Chemical processing industry, Oil & gas industry, and Pulp & paper industries).	9	20%	CO2
3	General principal of organic Reaction Reaction Intermediate, Types of organic reaction (Elimination and substitution reactions) and mechanism of Grignard Reaction, Friedel-Crafts Reaction, Reimer Tiemann reaction, Sandmeyer Reaction, Hofmann Rearrangement	9	20%	CO2 CO3
4	Analytical chemistry Spectroscopic Techniques and Applications: Elementary idea and simple applications of UV, IR and NMR, Numerical problems. Application in Chemical industry quality control example	9	20%	CO4
5	Nano-Materials Nano materials: Introduction, synthesis, and application: fullerenes, Carbon Nano tube, and Graphene. Bio mimic in Technology examples Self-assembling nanomaterials, Nanostructures based on butterfly wings, Nanopores inspired by cell membranes. Application of nano material in catalysis, textile, and medicine.	9	20%	CO5

Suggested Distribution of Theory Marks Using Bloom's Taxonomy						
Level	Remembrance	Understanding	Application	Analyse	Evaluate	Create
Weightage	25	25	20	15	10	5

NOTE: This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Suggested List of Experiments/Tutorials

Sr. No.	Name of Experiment/Tutorial	Teaching Hours
1	Preparation of graphene by chemical exfoliation and characterization of its properties	2
2	Determination of the concentration of a coloured species using UV-Vis spectrophotometry	2
3	Construction and characterization of a simple galvanic cell	2
4	Study of the effect of temperature on the rate of a reaction	2
5	Study of the effect of pH on the corrosion rate of a metal	2
6	Synthesis of aspirin and its analysis by spectroscopic methods such as UV and IR spectroscopy	2
7	Synthesis of a graphene oxide solution	2
8	Electrolysis of copper sulfate solution and determination of Faraday's constant	2
9	Synthesis of salicylic acid using Reimer-Tiemann reaction	2
10	Prepare a standard solution of Oxalic acid or potassium permanganate.	2

Major Equipment/ Instruments and Software Required

Sr. No.	Name of Major Equipment/ Instruments and Softwares
1	High-speed blender, ultrasonic bath, centrifuge, vacuum filtration setup, oven
2	UV-Vis spectrophotometer, cuvettes, sample solutions, deionized water
3	Electrodes (anode and cathode), wire, voltmeter, salt bridge, electrolyte solution, beakers.
4	Temperature-controlled water bath, thermometer, reaction vessel, stirring setup, pH meter
5	Corrosion testing apparatus, metal samples, pH meter, corrosion rate measurement apparatus.
6	Electrolysis cell, copper sulfate solution, electrodes, ammeter, voltmeter, stopwatch, weighing balance.
7	Round-bottom flask, reflux condenser, ice bath, heating mantle, glass rod, separating funnel, vacuum filtration setup, spectroscopy instruments (UV-Vis and IR).

Suggested Learning Websites

Sr. No.	Name of Website
1	https://www.khanacademy.org/science/chemistry
2	https://www.chemguide.co.uk/
3	https://ocw.mit.edu/courses/chemistry/
4	https://chem.libretexts.org/
5	https://www.rsc.org/

Reference Books

Sr. No.	Name of Reference Books
1	Chemical Kinetics and Reaction Mechanisms by James H. Espenson
2	Principles of Chemical Kinetics by James E. House
3	Principles of Electrochemistry by Mohammed A. A. Khalid
4	Electrochemistry by Carl H. Hamann, Andrew Hamnett, and Wolf Vielstich
5	Advanced Organic Chemistry by Jerry March
6	Organic Reaction Mechanisms by V. K. Ahluwalia
7	Reaction Mechanisms in Organic Chemistry by P. W. Atkins
8	Spectroscopic Methods in Organic Chemistry by Dudley H. Williams and Ian Fleming
9	Analytical Chemistry by Gary D. Christian
10	Fundamentals of Analytical Chemistry by Douglas A. Skoog, Donald M. West, F. James Holler, and Stanley R. Crouch
11	Nanotechnology: Principles and Applications by Sulabha K. Kulkarni
12	Introduction to Nanomaterials and Devices by Devendra K. Sadana
13	Nanomaterials: Synthesis, Properties and Applications by A.S. Edelstein and R.C. Cammarata
14	“Engineering chemistry”: Fundamentals and applications by Sikha Agarwal
15	“Chemistry for Engineers” by Amarika Singh and S Vairm
16	“Chemistry for Engineers” by B K Ambasta
17	“Chemistry for Engineers (WIND) “ by Rajesh Agnihotri