

**Code: 1BCHME102****Credits: 3****L: T:P: 2:2:0****SEE Hours: 3****Course: Applied Chemistry for Mechanical Engineering****CIE: 50 Marks****SEE: 50 Marks****Max. Marks:100**

Prerequisites if any	NA
Learning objectives	To impart a strong foundation in the principles of chemistry with emphasis on application-oriented topics relevant to Mechanical Engineering

Course Outcomes:*On the successful completion of the course, the student will be able to*

COs	Course Outcomes	Bloom's level
CO1	To understand the principle of corrosion and its control for technological applications.	Understand Apply
CO2	Understand and apply the basic concepts of fuels and energy conversion devices.	Understand Apply
CO3	Apply comprehensive knowledge in the field of engineering macromolecules and materials.	Understand Apply
CO4	To understand and apply the concept of analytical techniques in various technological applications.	Analyze Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2			2		2					3			
CO2	3	2			2		2					3			
CO3	3	2			2		2					3			
CO4	3	2			2		2					3			

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

	Applied Chemistry for Mechanical Engineering	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module-1: Corrosion Science and Advanced Metal protection				
1.1	Corrosion: Introduction, electrochemical theory of corrosion, Factors affecting the rate of corrosion: Nature of the metal, Physical state of the metal, Area effect, Nature of the corrosion product, pH, and Temperature.	1	1	0
1.2	Types of corrosion- Galvanic (differential metal), differential aeration (pitting), and stress corrosion (caustic embrittlement in industrial boilers).	2	0	0
1.3	Corrosion control: Cathodic protection - Sacrificial anode and impressed current method. Protective coatings: Metal coating: Galvanization & Tinning, Inorganic: Anodization and Phosphate coating, Organic coating, and Corrosion Inhibitors.	2	1	0
1.4	Corrosion penetration rate (CPR)- Definition, importance and numerical problems.	0	1	0
Module-2: Energy Systems and Analytical Techniques				
2.1	Energy Systems: Introduction to batteries, classifications, construction, working, and applications of Lithium ion and Sodium ion batteries.	2	0	0
2.2	Battery Parameters: Cell balancing importance, thermal management, state of charge (SOC), state of health (SOH), and fault detection. Recycling of batteries.	1	1	0
2.3	Analytical techniques: Introduction, principle, and applications of conductometry (estimation of strong, weak and acid mixture), potentiometry (estimation of FAS).	1	1	0
2.4	Determination of pKa using pH sensor. Colorimetric estimation of copper in e- waste.	1	1	0
Module-3: Macromolecules for Engineering Applications				
3.1	Polymers: Introduction, classification, synthesis, properties, and industrial applications of polyvinylchloride (PVC) and polystyrene (PS). Structure and property relationship of polymers. Glass transition temperature (Tg), factors affecting Tg and its significance.	2		0
3.2	3D Printing materials: Introduction, synthesis, properties and applications of polylactic acid (PLA) resin.		1	

3.3	Fibers and Plastics: Introduction, synthesis, properties, and industrial applications of Kevlar and Poly (methyl methacrylate) (PMMA). Molecular weight of a polymer by number average and weight average methods, and numerical problems.	2	1	0
3.4	Lubricants: Introduction, classification, properties (viscosity, pour point, cloud point, flash point, fire point, oiliness, saponification, emulsification, and volatility) and application of lubricants.	1	1	0
Module-4: Materials for Engineering Applications				
4.1	Alloys: Introduction, classification, composition, properties, and applications of Stainless Steel, Solders, Brass and Alnico. Estimation of Cu in brass by iodometric method and Iron in steel by external indicator method.	2	1	0
4.2	Metal finishing: Introduction, technological importance of metal finishing, Electroforming, Electro polishing, Electro chemical etching.	2	0	0
4.3	Factors affecting the nature of deposit - current density, pH, temperature, and throwing power of a plating bath.	2	0	0
4.4	Surface preparation for electroplating. Electroplating of chromium (hard and decorative) and Electroless plating of nickel. Difference between electroplating and electroless plating.	0	1	0
Module-5: Advances in Petroleum, Biofuels, and Combustion Science				
5.1	Fuels: Introduction, classification with examples, characteristics of a good fuel, calorific value - classification (GCV & NCV). Determination of calorific value of solid and liquid fuels using Bomb calorimeter and numerical problems.	2	1	0
5.2	Petroleum cracking- Thermal and Fluidized bed catalytic cracking. Reformation of petrol - explanation with reactions.	1	0	0
5.3	Knocking in internal combustion engines - knocking mechanism and its ill effects and prevention of knocking and anti-knocking agents: leaded and unleaded petrol. Importance of octane and cetane rating of fuel.	1	1	0
5.4	Green fuels: Introduction, Power alcohol - properties, applications, advantages and disadvantages, Biodiesel- synthesis by trans-esterification method, advantages and its applications. Construction, working, and importance of photovoltaic cells.	1	1	0
Total No. of Lecture Hours		26	0	0
Total No. of Tutorial sessions			14	0
Total no. of Practical Hours				0
Total No. of Hours/ session				40



Self-learning topics identified:

1. Case study: 1 Corrosion and its control
2. Case study: 2 Energy systems for EV
3. Case study: 3 Applications of Macromolecules
4. Case study: 4 Advanced materials for engineering applications
5. Case study: 5 Sustainable and Green fuels

Textbooks:

1. A Textbook of Engineering Chemistry, By S S Dara & S S Umare, Aruna M Sudame, S, Chand and company limited
2. Textbook of Engineering Chemistry by Shashi Chawla, Publisher: Dhanpat Rai, Edition: 6, 2022, Pages: 828.
3. Engineering Chemistry, 3rd edition, by R.V. Gadag, A. Nityananda Shetty, Publisher: Dreamtech Press

Reference books / Manuals:

1. Corrosion Engineering, M. G. Fontana, N. D. Greene, McGraw Hill Publications, New York, 3rd Edition, 1996.

Online Resources

1. https://onlinecourses.nptel.ac.in/noc22_mm17/preview
2. <https://nptel.ac.in/courses/10310511>