

22CH130 **CHEMISTRY**
(COMMON TO ALL BRANCHES)

Category	L	T	P	Credit
BS	3		0	3
TET	Theory			

Preamble

The objective of this course is to bestow basic concepts of chemistry and its applications in engineering domain. It imparts knowledge on properties and treatment methods of water, spectroscopic techniques and their applications. This course provides exposure on electrochemical techniques for corrosion control, surface coatings and energy storage devices and also emphasis the properties and applications of engineering materials.

Prerequisite

Nil

Course Outcomes

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

CO	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain the essential water quality parameters of water	TPS2	70	70
CO2	Determine hardness of water and identify suitable water treatment method	TPS3	70	70
CO3	Explain the electrochemical process involved in energy storage devices and corrosion of metals	TPS2	70	70
CO4	Interpret the electrochemical principles in modern energy storage devices and corrosion control methods	TPS3	70	70
CO5	Identify the appropriate spectroscopic technique for various applications	TPS3	70	70
CO6	Select the materials based on the properties for Engineering applications	TPS3	70	70

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1.	M	L	-	-	-	-	-	-	-	-	-	-
CO2.	S	M	L	-	-	-	L	-	-	-	-	-
CO3.	M	L	-	-	-	-	-	-	-	-	-	-
CO4.	S	M	L	-	-	-	-	-	L	-	-	-
CO5.	S	M	L	-	-	-	L	-	L	-	-	-
CO6.	S	M	L	-	-	-	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT1						CAT2						Terminal					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
TPS Scale																		
CO1	4	20	0										2	8				
CO2	4	0	20										2	4	10			
CO3	4	20	0										2	8				
CO4	8	0	20										2	4	10			
CO5							12	20	20				6	8	10			
CO6							8	20	20				6	8	10			

* Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

CO	Assignment 1*						Assignment 2*					
	1	2	3	4	5	6	1	2	3	4	5	6
TPS Scale												
CO1												
CO2			20									
CO3												
CO4			20									
CO5									20			
CO6									20			

*Assessment type: Quiz / Test / Presentation

Syllabus

Water: Water- sources- physical - characteristics - alkalinity - hardness of water – types - determination of hardness by EDTA method. Boiler trouble-Softening of water: Internal and External treatment methods. Waste water treatment process. **Electrochemical technologies for energy storage and surface engineering:** Electrochemistry and Energy storage: Basics of electrochemistry. Batteries - Primary and Secondary batteries. Fuel cells. Hydrogen generation and storage. Corrosion and Surface Engineering –Basics –Corrosion - causes-factors- types - corrosion of metal and computer components- Corrosion control. Electroplating - Electroless process. **Spectroscopic technique and applications:** Principle, instrumentation, and applications: X-ray-diffraction - UV-Visible spectroscopy- Atomic Absorption Spectroscopy - Fluorescence spectroscopy - Inductively Coupled Plasma - Optical Emission Spectroscopy- Infra-red spectroscopy - Nuclear magnetic resonance spectroscopy. **Engineering materials:** Bonding and their influences on the property of materials - melting point - brittleness, ductility – thermal, electrical, and ionic conductivity - optical – magnetic properties, hydrophobic, hydrophilic. **Polymer composites** - structure and properties-applications. **Ceramics and advanced ceramics** - types-properties-applications-**Nano-materials** – Synthesis, structure, and properties –applications.

Text Book

1. P.C. Jain and Monica Jain, A Textbook of Engineering Chemistry, DhanpatRai publications, New Delhi, 16th edition, 2015.

Reference Books & web resources

1. S.S. Dara and S.S. Umare, "A Textbook of Engineering Chemistry", S.Chand & Company, 12th Edition, Reprint, 2013.
2. Shashi Chawla, "A text book of Engineering Chemistry", Dhanpat Rai & Co.(pvt) ltd, 3rd edition, reprint 2011.
3. C. N. Banwell and E.M. McCash, "Fundamentals of Molecular Spectroscopy", Tata McGraw-Hill (India), 5th Edition, 2013.
4. W.F. Smith, Principles of Materials Science and Engineering: An Introduction; Tata Mc-Graw Hill, 2008.
5. V. Raghavan, Introduction to Materials Science and Engineering; PHI, Delhi, 2005.
6. M. Akay, 2015, An introduction to polymer matrix composites," from: https://www.academia.edu/37778336/An_introduction_to_polymer_matrix_composites

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Water	
1.1	Importance of water, sources, standards for drinking water, (WHO, BIS & ICMR standards) physical, chemical & biological characteristics, Alkalinity (principle only)	1
1.2	Hardness of water - types, units. Determination of hardness by EDTA method and numerical problems	2
1.3	boiler trouble: Scale and sludge formation, boiler corrosion, priming and foaming, caustic embrittlement	1
1.4	Internal treatment methods: Carbonate, Phosphate, Colloidal, Calgon conditioning	1
1.5	softening of water: External treatment methods: Lime-soda process (concept only), zeolite process, ion exchange process	2
1.6	Desalination- reverse osmosis, electro dialysis, solar and multistage flash distillation, nano-filtration	1
1.7	Waste water treatment – primary, secondary, and tertiary treatment	1
2	Electrochemical technologies for energy storage and surface engineering	
2.1	Electrochemistry and Energy storage: Introduction – Basics of electrochemistry – Redox process, EMF	1
2.2	Energy storage – Batteries, Battery quality parameters	1
2.3	Primary battery – Dry cell and Alkaline cell	1
2.4	Secondary battery – Lead-acid battery, Lithium-ion battery	1
2.5	Fuel cells – Fundamentals, types and applications. Hydrogen generation and storage	1
2.6	Corrosion and Surface Engineering - Basics – Corrosion - causes- factors- types	1
2.7	chemical, electrochemical corrosion (galvanic, differential aeration), corrosion of metal and computer components-	1

Module No.	Topic	No. of Periods
2.8	Corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method	1
2.9	Electroplating – Introduction, Process, Applications (Gold and nickel plating). Electroless plating – Principle, process, Applications (PCB manufacturing)	1
3	Spectroscopic technique and applications	
3.1	Introduction to Electromagnetic Radiation, Types of atomic and molecular spectra	1
3.2	Principle, Instrumentation and Applications: X-ray-diffraction	1
3.3	UV–Visible spectroscopy, Atomic Absorption Spectroscopy	2
3.4	Fluorescence spectroscopy, Inductively Coupled Plasma - Optical Emission Spectroscopy	2
3.5	Infra-red spectroscopy	2
3.6	Nuclear magnetic resonance spectroscopy – Magnetic resonance imaging	1
4	Engineering materials	
4.1	Bonding and its influence on the property of materials	1
4.2	Properties of materials- melting point - brittleness, ductility - thermal, electrical and ionic conductivity	1
4.3	optical – magnetic properties, hydrophobic, hydrophilic	1
4.4	Polymer composites - structure and properties	1
4.5	applications - automotive, aerospace, marine, biomedical, and defense	1
4.6	Ceramics and advanced ceramics - types-properties	1
4.7	applications- medicine, electrical, electronics, space	1
4.8	Nano-materials – Synthesis, structure and properties	1
4.9	applications - sensors, drug delivery, photo and electro-catalysis, and pollution control	1
	Total	36

Course Designer(s):

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