26PH108	Physical Science Laboratory - Chemistry	L	T	P	C
		0	0	2	1

Prerequisite	Assessment Pattern		
Atomic structure, Chemical bonding, and Redox reactions	CIA	SEE	Total
	60	40	100

Course Outcomes (COs)

At the end of the course, students will be able to

1. Apply electrochemical techniques to determine cell EMF, conductivity and concentration of iron present in the given water samples
2. Apply analytical technique to identify the chromium concentration in industrial and environmental samples
3. Apply the principles of surface chemistry and adsorption to assess the adsorption ability of activated charcoal in the removal of heavy metals (such as chromium or nickel) from aqueous solutions
4. Analyze the quality of given water sample by measuring hardness/pH and interpret their suitability for domestic use.
5. Analyze the corrosion in concrete TMT bars and determine Fe^{2+} content in mild steel alloys to evaluate material degradation

Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	2	1				2			1		1		
CO 2	2	1				1			1		1		
CO 3	1	2				2					1		
CO 4	2	2				1			1		1		
CO 5	2	1				1					1		

Lab safety guidelines

Smart and Safe Experiments: OSHA Laboratory Precautions for Beginners **1 Hour**

Module 1 (Any three experiments)

Experiment 1 **3 Hours**

Construction of a simple electrochemical cell (Cu–Zn) and measurement of its potential.

Experiment 2 **3 Hours**

Assess the adsorption ability of activated charcoal in heavy metal (chromium/nickel) removal

Experiment 3 **3 Hours**

Determine the amount of electrolyte present in the industrial effluent by conductometric titration

Experiment 4

Redox titration: Potentiometric Analysis of iron (Fe^{2+}) present in the given water sample using $KMnO_4$

Module 2 (Any three experiments)

Experiment 5 **3 Hours**

Estimation of Hardness in water sample by EDTA method.

Experiment 6 **3 Hours**

Determination of acid content by measuring pH (Use pH Meter)	
Experiment 7	**3 Hours**
Evaluate the corrosion percentage in concrete TMT bars.	
Experiment 8	
Investigate the amount of Iron (Fe^{2+}) in a mild steel alloy sample using a spectrophotometer.	
Self-Learning	**11 Hours**
NOC: Water Quality Management Practices, Prof. Gourav Dhar Bhowmick IIT Kharagpur https://nptel.ac.in/courses/126105335 Elementary Electrochemistry, Prof. Angshuman Roy Choudhur, IISER Mohali https://onlinecourses.nptel.ac.in/noc23_cy19/preview	
Practical	**19 Hours**
TW/SL	**11 Hours**
Total	**30 Hours**

References

1. Vogel, A. I., Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition, Pearson,2009
2. Skoog, West and Holler, Fundamentals of Analytical Chemistry, 10th Edition, 2022
3. Fontana, M. G., Corrosion Engineering, 4th Edition, 2017.

26PH108	Physical Science Laboratory - Physics	L	T	P	C
		0	0	2	1

Prerequisite	Assessment Pattern		
Principles of interference and diffraction of light. Characteristics of laser light. Skills in data observation, measurement, and error calculation.	CIA	SEE	Total
	60	40	100

Course Outcomes (COs)

At the end of the course, students will be able to

1. Demonstrate the ability to measure and record physical parameters such as radius, diameter, thickness, and refractive index.
2. Determine and analyze mechanical properties like Young's modulus, rigidity modulus, and moment of inertia.
3. Investigate optical phenomena to measure thickness, wavelength, and particle size using interference and diffraction methods
4. Analyze I–V characteristics and energy band gap to evaluate performance parameters of solar cells and PN junction diodes.
5. Interpret and apply experimental data to understand material behavior and solve engineering problems.

Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	2	1					1		1		1		
CO 2	2	1					1		1		1		
CO 3	2	1					1		1		1		
CO 4	2	1					1		1		1		
CO 5	2	1					1		1		1		

Module 1 (Any three experiments)

Experiment 1 **3 Hours**

Assess the physical parameters (radius, diameter, and thickness) of various engineering materials using precision instruments like the screw gauge, Vernier caliper, and travelling microscope

Experiment 2 **3 Hours**

Determine the moment of inertia of a given disc by torsional oscillations and evaluate the rigidity modulus of the material of the suspension wire

Experiment 3 **3 Hours**

Apply the non-uniform bending method to determine the Young's modulus of a uniform bar and analyze its mechanical properties for engineering applications.

Experiment 4

Analyze the thickness of a thin sheet or wire by observing the interference pattern in an air-wedge arrangement

Module 2 (Any three experiments)

Experiment 5 **3 Hours**

Evaluate the wavelength of a laser source and assess the size of the given microparticles (Lycopodium powder) using appropriate experimental techniques	
Experiment 6	**3 Hours**
Determine the efficiency of a solar cell by experimentally plotting its current-voltage (I–V) characteristics curve	
Experiment 7	**3 Hours**
Measure the characteristics of a PN junction diode to determine the energy band gap of the semiconductor material.	
Experiment 8	
Investigate the refractive indices of a glass slab and water by measuring their apparent thickness using a travelling microscope.	
Self-Learning	**11 Hours**
NOC: Experimental Physics I, Prof. Amal Kumar Das https://onlinecourses.nptel.ac.in/noc20_ph16/preview Experimental Physics II, Prof. Amal Kumar Das https://onlinecourses.nptel.ac.in/noc24_ph06/preview	
Practical	**19 Hours**
TW/SL	**11 Hours**
Total	**30 Hours**
References	
1. Knight, R. D., "Physics for Scientists and Engineers: A Strategic Approach with Modern Physics," 4th Edition, Pearson, 2017 2. Prakash, I., Ramakrishna, "A Textbook of Practical Physics," 11th Edition, Kitab Mahal, 2011	