

Course Code	Course Title	Category	L	T	P	C
CY23131	CHEMISTRY FOR ELECTRONICS ENGINEERING	BS	3	0	2	4
Common to I sem. B.E. –Electronics and Communication Engineering, Biomedical Engineering, Electrical and Electronics Engineering, Mechatronics and Robotics & Automation						

Objectives:

- To understand the principles of electrochemical processes
- To explore the functioning of sensors and their applications in industries and health care
- To get familiarized with the functioning of batteries and fuel cells
- To acquire knowledge on polymeric materials used in electronics
- To develop proficiency in nanomaterials

UNIT-I	DYNAMIC ELECTROCHEMISTRY	9
Applied Electrochemistry: Electrode Potential - EMF series - Corrosion- Causes, Consequences and Prevention. Surface Preparation- electropolishing -Electroplating of copper, electrophoretic deposition - Electrochemical machining, electrochemical etching - electrochemical etching of Cu from PCB.		
UNIT-II	ELECTROCHEMICAL SENSORS	9
Electrodes - reference electrodes - ion-selective electrode, determination of electrode potential- Galvanic and concentration cells - potentiometric, amperometric and conductometric methods of analysis - potentiometric sensor, optical sensor, thermal sensor, chemical biosignals- sensors for health care – glucose and urea sensors, gas sensors for CO ₂ , O ₂ and NH ₃ sensing- blood oxygen sensor.		
UNIT-III	ELECTROCHEMICAL ENERGY SYSTEMS	9
Batteries- types - characteristics-fabrication and working of lead-acid battery- NICAD battery – Nickel metal hydride batteries -lithium-ion battery - Supercapacitors- introduction - types - electrochemical double layer capacitor - activated carbon - carbon aerogels. Fuel cells - classification – principle, working and applications of hydrogen-oxygen fuel cell - solid oxide fuel cell - direct methanol fuel cell and proton exchange membrane fuel cells-biofuel cells.		
UNIT-IV	POLYMERS IN ELECTRONICS	9
Conducting polymers - conducting mechanisms- polyaniline, Poly pyrrole - photonic polymers - photo resists - Introduction, Liquid crystalline phases, Identification of the mesophases, Lyotropic main chain liquid crystalline polymers, Thermotropic main chain liquid crystal polymers, Applications of liquid Crystals in Displays (LCDs) - Organic LEDs- functioning-advantages and disadvantages over conventional LEDs- commercial uses.		
UNIT-V	NANO MATERIALS	9
Introduction-Types of nanomaterials-Emergence and challenges in nanotechnology- Synthesis routes for nanomaterials: Bottom-up and top-down approaches- Sol-gel, precipitation, Hydrothermal, Solvothermal, Microwave irradiation, Chemical Vapour Deposition (CVD), Electro deposition- Properties of nanomaterials- Mechanical properties, Chemical, Optical, Electrical and Magnetic properties-applications of nanomaterials.		
Total Contact Hours: 45		

Description of the Experiments

1.	Construction and determination of EMF of simple electrochemical cells and concentration cells
2.	Estimation of acids by pH metry
3.	Determination of corrosion rate on mild steel by weight loss method
4.	Estimation of mixture of acids by conductometry
5.	Estimation of extent of corrosion of iron pieces by potentiometry
6.	Estimation of copper / ferrous ions by spectrophotometry
7.	Estimation of DO by using sensors
8.	Estimation of concentration of sulphate/chloride ions in the given sample solution.
9.	Determination of molecular weight of a polymer by viscometry method
10.	Synthesis of nanomaterials by simple precipitation method
Total Contact Hours:30	

Course Outcomes:

- Apply the knowledge of electrochemistry in exploring electrochemical processes.
- Associate the knowledge of sensors in health care and in pollution abatement
- Recognize the types of batteries and fuel cells
- Employ advanced materials in industrial applications and display techniques

SUGGESTED ACTIVITIES

- Develop nano and biomaterials for medical applications
- Electroplating process by group of students
- Ceramic coating on implant materials
- Electropolishing of metals and alloys

SUGGESTED EVALUATION METHODS

- Continuous assessment tests
- Assignments
- Model lab examination
- End semester examination

Text Book(s):

1. P. C. Jain and Monika Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015
2. O.G. Palanna, "Engineering Chemistry", McGraw Hill Education (India) Pvt, Ltd, New Delhi, 2017
3. Shikha Agarwal "Engineering Chemistry-Fundamentals and applications", Cambridge University Press, New Delhi, 2015

Reference Books(s) / Web links:

- Gowarikar V. R., Viswanathan N.V. and Jayadev Sreedhar, —Polymer Science, New Age International (P) Ltd., New Delhi, 2011
- Sujata V Bhat, "Biomaterials", Narosa Publishing House, New Delhi, 2002
- Pradeep T, "A Text Book of Nanoscience and Nanotechnology", Tata McGraw Hill, New Delhi, 2012
- An Introduction to Nanomaterials and Nanoscience (PB 2020) : Asim K Das, Mahua Das, CBS publishers and distributors Pvt. Ltd.
- NPTEL course Elementary Electrochemistry course url
https://onlinecourses.nptel.ac.in/noc23_cy19/preview
- For downloading text/reference books the weblink is given below can be used
<http://libgen.rs/>

Lab equipment required:

S. No	Name of the Equipment	Quantity Required	Remarks
1.	Oxygen sensors	10	
2.	Ion selective electrodes for various ions in solution	10	
3	Spectrophotometer	4	
4	Magnetic stirrer with hot plate	10	

SUGGESTED EVALUATION METHODS

1. Experiment based viva
2. Quizzes

Web links for virtual lab (if any)

<https://drive.google.com/drive/folders/1k8g7fGRJ0D18FPbjQYg4I5jS1U9qIXnJ>

Prepared by Name and signature	Approved by Name and Signature