

BLOW UP SYLLABUS
First/Second Semester B.E.

Chemistry for Electrical & Electronic Engineering Stream(22CHEE12/22)
(Effective from the academic year 2022-23)

Topics	Topics To Be Covered	Hours
MODULE 1: Chemistry of Electronic Materials		
Conductors and Insulators:	Conductors and Insulators: Definition of conductors, semiconductor and insulators based on band theory, principle with examples taking Cu, Si and Quartz or any suitable example. Semiconductors: Introduction, production of electronic grade silicon from quartz i) Czochralski process (CZ) and ii) Float Zone (FZ) methods	2L
Polymers: Conducting polymers Graphene Oxide: PCB:	Polymers: Importance and developments in the field of polymers, Definition of number and weight average molecular mass, along with Formulae. Numerical problems on Number average and Weight average molecular mass Conducting polymers – synthesis of polyacetylene, Conducting mechanism of polyacetylene (explanation in terms of either p or n-doping) steps involved include polaron, bipolaron and soliton pair simple addition technique, zeiglerNutta catalyst). Graphene Oxide: Preparation (hummers method), properties and commercial applications (any 4 each). i) PCB: Electroless plating – Introduction, Electroless plating of Copper in the manufacture of double-sided PCB.	5L
Tutorials	i) Involvement of faculty and students in identifying the problems & solutions. ii) PPT presentations by the students/faculty about the applications of the different materials used in Electrical Engineering iii) Guidance to the students for self-study topics through illustrative examples.	2T
Self-learning: Technological importance of metal finishing and distinction between electroplating and electroless plating.	1. No Question is to be set for SEE 2. 20% weightage may be given to CIE from self-study topics	
(RBT Levels: L1, L2 & L3)		Total
		8
MODULE 2: Energy Source, Conversion and Storage		
Batteries:	Batteries: Introduction, classification of batteries as primary, secondary and reserve batteries with examples Components, construction, working and applications of modern batteries; i) Na-ion battery, ii) solid state battery (Li-polymer battery) iii) flow battery (Vanadium redox flow battery)	3L

Fuel Cells:	Fuel Cells: Introduction, construction, working and applications of methanol–oxygen fuel cell and polymer electrolyte membrane (PEM) fuel cell Solar Energy: Introduction, importance of solar PV cell, Construction and working of solar PV cell, advantages and disadvantages.	4L
Solar Energy:		
Tutorials	i)Involvement of faculty and students in identifying the problems & solutions. ii)PPT presentations by the students/faculty about the applications of the different Energy conversion & storage materials used in Electrical stream iii) Guidance to the students for self-study topics through illustrative examples.	2T
Self-learning: Electrodes for electrostatic double layer capacitors, pseudo capacitors, and hybrid capacitor	1.No Question is to be set for SEE 2.20% weightage may be given to CIE from self-study topics	
(RBT Levels: L1, L2 & L3)		Total
8		
MODULE 3: Corrosion Science and E-waste Management		
Corrosion Chemistry:	Corrosion Chemistry: Introduction(ill effects, global losses, technological importance), electrochemical theory of corrosion (principle, reactions under different conditions and diagram taking iron as an example) Types of corrosion- differential metal ((Definition, Principle, Process and application) Differential aeration (principle, explanation with examples), Corrosion control – (Definition, Principle, Process and application) galvanization, Anodization and sacrificial anode method Corrosion Penetration Rate (CPR) (Definition and formula) - Introduction and numerical problems.	4L
Types of corrosion-		
Corrosion control		
Corrosion Penetration Rate		
E-waste Management:	E-waste Management: Introduction (ill effects of e-waste management, global losses, environmental importance), sources, types, effects of e-waste on environment and human health, methods of disposal(Classification) , advantages of recycling. Extraction of copper and gold from e-waste(Principle, process, taking PCB as an example)	3L
Tutorials	i)Involvement of faculty and students in identifying the problems & solutions. ii)PPT presentations by the students/faculty about prevention of corrosion, and handling of e-waste generated in Electrical stream iii) Guidance to the students for self-study topics through illustrative examples.	2T
Self-learning: Recycling of PCB and battery components .	1.No Question is to be set for SEE 2.20% weightage may be given to CIE from self-study topics	
(RBT Levels: L1, L2 & L3)		Total
8		

MODULE 4: Nanomaterials and Display Systems		
Nanomaterials:	Nanomaterials: Introduction, size dependent properties of nanomaterials (Surface area, Catalytic, Conducting) Preparation of nanomaterials by sol-gel and co-precipitation method with example. Introduction, properties and applications - Nanofibers, Nanophotonics, Nanosensors	3L
Display Systems:	Display Systems: Liquid crystals (LC's) - Introduction, classification, properties Display Systems: Liquid crystals (LCD's) - Introduction, classification, Properties and application in Liquid Crystal Displays (LCD's). Properties and application of Organic Light Emitting Diodes (OLED's) Properties and application of Quantum Light emitting diodes (QLED's)	4L
Perovskite Materials:	Perovskite Materials: Introduction, properties and applications in optoelectronic devices (solar cells).	
Tutorials	i)Involvement of faculty and students in identifying the problems & solutions. ii)PPT presentations by the students/faculty about the different new nanomaterials used in Electrical Engineering iii)Guidance to the students for self-study topics through illustrative examples.	2T
Self-learning: Properties & electrochemical applications of carbon nanotubes and graphene.	1.No Question is to be set for SEE 2.20% weightage may be given to CIE from self-study topics	
(RBT Levels: L1, L2 & L3)		Total
8		
MODULE 5: Sensors in Analytical Techniques		
Electrode System:	Electrode System: Introduction, types of electrodes Ion selective electrode – definition, construction, working and applications of glass electrode. Determination of pH using glass electrode Reference electrode - Introduction, calomel electrode – construction, working and applications of calomel electrode Concentration cell (Electrolyte) – Definition, construction and Numerical problems	3L
Sensors:	Sensors: Introduction, general working principle (schematic diagram and explanation) and applications of conduct metric sensors Introduction, brief working principle and applications electrochemical sensors, Thermometric sensors, and Optical sensors.(No instrumentation)	4L
Analytical Techniques:	Analytical Techniques: Introduction, principle and instrumentation of Colorimetric sensors;application in estimation of the Copper, principle and instrumentation of Potentiometric	

	sensors;application in estimation of the Iron, principle and instrumentation of Conductometric sensors;application in estimation of the weak acid.	
Tutorials	i)Involvement of faculty and students in identifying the problems & solutions. ii)PPT presentations by the students/faculty about the applications of the different materials used as sensors in Electrical Engineering iii)Guidance to the students for self-study topics through illustrative examples.	2T
Self-learning: IR and UV-Visible spectroscopy	1.No Question is to be set for SEE 2.20% weightage may be given to CIE from self-study topics	
(RBT Levels: L1, L2 & L3)		Total
		8

NOTE: Wherever the contact hours is not sufficient, tutorial hour can be converted to theory hours

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Wiley Engineering Chemistry, Wiley India Pvt. Ltd. New Delhi, 2013- 2nd Edition.
2. Engineering Chemistry, Satyaprakash& Manisha Agrawal, Khanna Book Publishing, Delhi
3. A Text Book of Engg. Chemistry, Shashi Chawla, Dhanpat Rai & Co. (P) Ltd.
4. Essentials of Physical Chemistry, Bahl&Tuli, S.Chand Publishing
5. Applied Chemistry, Sunita Rattan, Kataria 5. Engineering Chemistry, Baskar, Wiley
6. Engineering Chemistry – I, D. Groukrishana, Vikas Publishing
7. A Text book of Engineering Chemistry, SS Dara & Dr. SS Umare, S Chand & Company Ltd., 12thEdition, 2011.
8. A Text Book of Engineering Chemistry, R.V. Gadag and Nityananda Shetty, I. K. International Publishing house. 2nd Edition, 2016.
9. Text Book of Polymer Science, F.W. Billmeyer, John Wiley & Sons, 4th Edition, 1999.
10. Nanotechnology A Chemical Approach to Nanomaterials, G.A. Ozin& A.C. Arsenault, RSC Publishing, 2005.
11. Corrosion Engineering, M. G. Fontana, N. D. Greene, McGraw Hill Publications, New York, 3rd Edition, 1996.
12. Linden's Handbook of Batteries, Kirby W. Beard, Fifth Edition, McGraw Hill, 2019.
13. OLED Display Fundamentals and Applications, TakatoshiTsujimura, Wiley–Blackwell , 2012
14. Supercapacitors: Materials, Systems, and Applications, Max Lu, Francois Beguin,ElzbietaFrackowiak, Wiley-VCH; 1st edition, 2013.
15. “Handbook on Electroplating with Manufacture of Electrochemicals”, ASIA PACIFIC BUSINESSPRESS Inc., 2017. Dr. H. Panda,
16. Expanding the Vision of Sensor Materials. National Research Council 1995, Washington, DC: The National Academies Press. doi: 10.17226/4782.
17. Engineering Chemistry, Edited by Dr. Mahesh B and Dr. Roopashree B, Sunstar Publisher, Bengaluru, ISBN 978-93-85155-70-3, 2022
18. High Performance Metallic Materials for Cost Sensitive Applications, F. H. Froes, et al. John Wiley & Sons, 2010
19. Instrumental Methods of Analysis, Dr. K. R. Mahadik and Dr. L. Sathiyarayanan, NiraliPrakashan, 2020
20. Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch SeventhEdition, Cengage Learning, 2020

21. Polymer Science, V R Gowariker, N V Viswanathan, Jayadev, Sreedhar, Newage Int. Publishers, 4th Edition, 2021
22. Engineering Chemistry, P C Jain & Monica Jain, Dhanpat Rai Publication, 2015-16th Edition.
23. Nanostructured materials and nanotechnology, Hari Singh, Nalwa, academic press, 1st Edition, 2002.
24. Nanotechnology Principles and Practices, Sulabha K Kulkarni, Capital Publishing Company, 3rd Edition 2014
25. Principles of nanotechnology, Phanikumar, Scitech publications, 2nd Edition, 2010.
26. Chemistry for Engineering Students, B. S. Jai Prakash, R. Venugopal, Sivakumaraiah & Pushpa Iyengar., Subash Publications, 5th Edition, 2014
27. "Engineering Chemistry", O. G. Palanna, Tata McGraw Hill Education Pvt. Ltd. New Delhi, Fourth Reprint, 2015.
28. Chemistry of Engineering materials, Malini S, K S Anantha Raju, CBS publishers Pvt Ltd., Laboratory Manual Engg. Chemistry, Anupma Rajput, Dhanpat Rai & Co.

Web links and Video Lectures:

- <http://libgen.rs/>
- <https://nptel.ac.in/downloads/122101001/>
- <https://nptel.ac.in/courses/104/103/104103019/>
- <https://ndl.iitkgp.ac.in/>
- <https://www.youtube.com/watch?v=faESCxAWR9k>
- <https://www.youtube.com/watch?v=TBqXMWaxZYM&list=PLyhmwFtznRhuz8L1bb3X-9IbHrDMjHWWH>
- <https://www.youtube.com/watch?v=j5Hml6KN4TI>
- <https://www.youtube.com/watch?v=X9GHBdyYcyo>
- <https://www.youtube.com/watch?v=1xWBPZnEJk8>
- <https://www.youtube.com/watch?v=wRAo-M8xBHM>