

**Blow-up syllabus
First/Second Semester B.E.**

**Chemistry for Mechanical Engineering stream(22CHEM12/22)
(Effective from the academic year 2022-23)**

Topics	Topic to be covered	Hours
Module-1: Energy; Source, Conversion and Storage		
Fuels:	Fuels: Introduction, (definition and classification of chemical fuels); calorific value, GCV and NCV of fuels (definition). Principle, experiment and working of bomb calorimeter to determine GCV and NCV. Numerical problems.	2L
Green fuels: High energy fuels:	Green fuels: Introduction, biodiesel its synthesis by transesterification method & applications. Definition of power alcohol, combustion characteristics, High energy fuels: Introduction, Preparation of hydrogen by electrolysis of water. Advantages of hydrogen as fuel,	2L
Energy devices:	Energy devices: Introduction, construction, working, and applications of Photovoltaic cells. Introduction, construction, working with reactions and applications of Li – ion battery	2L
Fuel cells:	Fuel cells: Introduction, construction, working with reactions and applications of Methanol-Oxygen fuel cell.	1L
Tutorial	Guidance to students for self study components through examples.	1L
Self-Learning: plastic recycling to fuels and and its monomers or other useful products.	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 hours
Module-2: Corrosion Science and Metal Finishing		
Corrosion:	Corrosion: Introduction (ill effects, global losses, technological importance), Electrochemical theory of corrosion, (principle, reactions under different conditions and diagram taking iron as an example),	1L
Types of corrosion:	Types of corrosion: Differential metal (definition, explanation with examples), Differential aeration (definition, explanation with examples for waterline and pitting), Stress corrosion (definition, explanation of caustic embrittlement as an example).	1L
Corrosion control:	Corrosion control: Metal Coating - Galvanization (Definition, Process and application), Surface conversion coating - Anodization (Definition, process and applications), Cathodic Protection- (Definition, principle, process	2L

	and applications of Sacrificial anode method) Corrosion Testing- Weight loss method and Corrosion penetration rate (CPR)- Definition, explanation and numerical problems.	
Metal finishing:	Metal finishing: Introduction, definition of metal finishing, technological importance. Introduction to electroplating, electroplating of chromium (hard and decorative). Introduction to Electro less plating, electro less plating of Nickel, (Principle, reactions & applications).	3L
Tutorial	Guidance to students for self study components through examples.	1L
Self-Learning: Factors affecting the rate of corrosion, factors influencing the nature and quality of electrodeposit (Current density, concentration of metal ion, pH and temperature).	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 hours
Module-3: Macromolecules for Engineering Applications		
Polymers:	Polymers: Introduction, methods of polymerization: Condensation and Free radical with examples. Explanation of molecular weight determination by number average and weight average methods, numerical problems. Synthesis, properties and industrial applications of polyvinylchloride (PVC) and polystyrene.	2L
Fibers: Plastics:	Fibers: Introduction to fibers, synthesis, properties and industrial applications of Kevlar. Synthesis, properties and industrial applications of Polyester. Plastics: Introduction, Synthesis, properties and industrial applications of poly (methyl methacrylate) (PMMA), synthesis, properties and industrial applications of Teflon.	3L
Composites: Lubricants:	Composites: Introduction to composites, properties and industrial applications of carbon-based reinforced composites (graphene/carbon nano-tubes as fillers) properties and industrial applications of metal matrix polymer composites. Lubricants: Introduction, classification, properties and industrial applications of lubricants.	2L
Tutorial	Guidance to students for self study components through examples.	1L
Self-learning: Biodegradable polymer:	1.No Question is to be set for SEE 2. 20% weightage may be given to CIE from self-study topics	

Introduction, synthesis, properties and applications of polylactic acid (PLA).		
(RBT Levels: L1,L2 & L3)		Total
		8 hours
Module-4: Phase Rule and Analytical Techniques		
Phase rule:	Phase rule: Introduction, definition of terms: phase, components, degree of freedom with example, explanation of phase rule equation (no derivation). Discussion of lead-silver two component system along with phase diagram	3L
Analytical techniques:	Analytical techniques: Introduction to analytical techniques, Principle, instrumentation of potentiometric titration; its application in the estimation of FAS (Ferrous Ammonium Sulphate) .	2L
	Principle, instrumentation of colorimetric and its application in the estimation of the copper.	1L
	Principle, instrumentation of Glass electrode and its application in the determination of pH of beverages.	1L
Tutorial	Guidance to students for self study components through examples.	1L
Self-learning: Determination of viscosity of biofuel and its correlation with temperature.	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 hours
Module-5: Materials for Engineering Applications		
Alloys:	Alloys: Introduction, classification, composition, properties and applications of Stainless Steel, Brass and Alnico.	2L
Ceramics:	Ceramics: Introduction, classification based on chemical composition, properties and applications of perovskites (CaTiO ₃).	1L
Nanochemistry:	Nanochemistry: Introduction, size-dependent properties of nanomaterial (surface area, catalytical and thermal), synthesis of nanoparticles by sol-gel, and co-precipitation method.	2L
Nanomaterials:	Nanomaterials: Introduction, properties and engineering applications of carbon nanotubes and graphene.	2L
Tutorial	Guidance to students for self-study components through examples.	1L
Self-learning: Abrasives: Introduction, classification, properties and applications of silicon carbide (carborundum).	1.No Question is to be set for SEE 2. 20% weightage may be given to CIE from self-study topics	

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., 12th Edition, 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, Takatoshi Tsujimura, Wiley-Blackwell, 2012
14. Supercapacitors: Materials, Systems, and Applications, Max Lu, Francois Beguin, Elzbieta Frackowiak, Wiley-VCH; 1st edition, 2013.
15. "Handbook on Electroplating with Manufacture of Electrochemicals", ASIA PACIFIC BUSINESS PRESS 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](#), Nirali Prakashan, 2020
20. Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch Seventh Edition, 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>