BLOW UP SYLLABUS

First/Second Semester B.E.

Chemistry for Civil Engineering Stream(22CHEC12/22)

(Effective from the academic year 2022-23)

Topics	Topics To Be Covered	Hours
Module–I: Structural Materials		
Metals and Alloys: **Cement:**	**Metal and Alloys**: Introduction (Definitions and types of alloys), Properties and applications of Iron and its alloys (Stainless Steel). Aluminium and its alloys (Duralumin and Aluminium-Mg alloy). **Cement:** Introduction, composition, properties, classification, manufacturing process of cement (Wet method). Process of setting and hardening of cement. Additives for cement (Accelerators, Retarders, Extenders & dispersants) and Testing of cement (% of CaO by EDTA method).	**4L**
Refractories: **Glass:**	**Refractories:** Introduction (Definition), classification based on chemical composition,Properties and applications of refractory materials. **Glass:** Introduction (Definition), Composition, Types, Preparation of Soda-lime glass. Properties and applications of glass.	**3L**
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 civil Engineering** iii) Guidance to the students for self-study topics through illustrative examples.	**2T**
Self-study: Chemistry of reinforced concrete from various sources of water (seawater, groundwater, treated water).	**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–II: Energy Conversion and Storage, Corrosion		
Energy conversion . **Storage devices**	**Energy conversion**: Introduction (Definition of solar energy), construction, working andapplications of Photovoltaic cells. Methanol-oxygen fuel cell (Definition of fuel cell, construction, working, advantages andapplications **Storage devices**: Introduction (Definition of Battery, secondary battery), construction andworking of Li-ion battery	**3L**
Corrosion:	**Corrosion:** Introduction (Definition and global losses, technological importance), electrochemical corrosion of steel in concrete (Electrochemical theory of corrosion with all reactions) Types (differential metal and aeration) - (Definition, diagram and corrosion reactions with example). Stress corrosion in civil structures: principle, Explanation of caustic embrittlement as an example, Corrosion control (Introduction)design and selection of materials. Galvanization and Anodization (Introduction, definition, process and applications) Sacrificial anode method (Introduction, definition and application)	**4L**
Tutorials	i) Involvement of faculty and students in identifying the problems & solutions. ii) **PPT presentations by the students/faculty about the different other methods to avoid corrosion, about other energy sources** iii) Guidance to the students for self-study topics through illustrative examples.	**2T**

Self-Study: Corrosion inhibitors	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-III: Water Technology and Nanotechnology		
Water Technology	**Water Technology**: Introduction, water parameters (pH, Alkalinity, Fluoride, Nitrate) Hardness of water, determination of temporary, permanent and total hardness by EDTA method. Numerical problems (temporary, permanent and total hardness), Softening of water by Ion exchange method, Desalination of water by electrodialysis, determination of COD, Numerical problems. Forward osmosis: Introduction (Definition), Process (Diagram & Explanation) and applications	**4L**
Nanotechnology: **Nano materials:**	**Nanotechnology**: Introduction (Definition of Nanomaterials), size dependent properties of nanomaterials (surface area and catalytic). Synthesis of nanomaterials by Sol-gel method (Explanation of sol and gel formation with reactions) and co-precipitation method **Nano materials:**Properties and engineering applications of carbon nanotubes (CNT& MWCNT) and graphene.Properties and applications Nanometal oxides for water treatment (TiO2 & Silver oxide).	**3L**
Tutorials	i)Involvement of faculty and students in identifying the problems & solutions. **ii)PPT presentations by the students/faculty about the different developments in nanotechnology & water technology** iii) Guidance to the students for self-study topics through illustrative examples	**2T**
Self-study: Sewage treatment (Primary, secondary and tertiary)	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-IV: Polymer and Composites		
Polymer: **Fibers :** **Polymer composites**:	**Polymer:** Introduction, methods of polymerization, molecular weight of polymers, numerical problems. Synthesis, properties and engineering applications of polyethylene (PE) and Chloropolyvinyl chloride (CPVC). **Fibers**: Synthesis, properties and applications of nylon fibers. **Polymer composites**: Introduction, properties and applications of fiber reinforcedpolymers composites (FRPC),	**4L**
Geo polymer concrete: **Adhesives**: **Biodegradable polymers**:	**Geo polymer concrete**: Introduction, synthesis, constituents, properties and applications. **Adhesives**: Introduction, properties and applications of epoxy resin. **Biodegradable polymers**: Synthesis of polylactic acid (PLA) and their applications	**3L**
Tutorials	i)Involvement of faculty and students in identifying the problems & solutions. ii**) PPT presentations by the students/faculty about the different**	**2T**

	developments in polymer technology **iii)** Guidance to the students for self-study topics through illustrative examples.	
Self-study: Introduction, structural properties, and applications ofcellulose and lignin.	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-V: Phase Rule and Analytical Techniques		
Phase rule:	**Phase rule**: Introduction, definition of terms: phase, components, degree of freedom,phase rule equation. Phase diagram: (Introduction, definition) Two component-lead-silver system.	**2L**
Analytical techniques:	**Analytical techniques**: Introduction, Advantages Potentiometric sensors: (Principle, instrumentation, working) and itsapplication in the estimation of iron. Conductometric sensors: (Principle, instrumentation, working) and itsapplication in the estimation of acid mixture (Weak acid v/s Strong base). pH – sensors: (Principle, instrumentation, working of glass electrode) and itsapplication in the determination of soil sample.	**5L**
Tutorials	i) Involvement of faculty and students in identifying the problems & solutions. ii**) PPT presentations by the students/faculty about the different advanced Analytical techniques** **iii)** Guidance to the students for self-study topics through illustrative examples	**2T**
Self-study: Chromatographic technique, application of chromatography (column and thin-layered chromatography) in the separation of 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**

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. GrourKrishana, 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, RSCPublishing, 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: TheNational 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. Sathiyanarayanan, 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& PushpaIyengar., Subash Publications, 5th Edition, 2014
27. "Engineering Chemistry", O. G. Palanna, Tata McGraw Hill Education Pvt. Ltd. New Delhi, FourthReprint, 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**