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| <b>Course Code :<br/>CHY1001</b>   |   | <b>Engineering Chemistry</b> |  | <b>Course Type</b> | <b>LTP</b> |
|  |   |                              |  | <b>Credits</b>     | <b>4</b>   |
| <b>Prerequisite:</b>   |   | Nil                          |  |                    |            |
| <b>Course Objectives:</b>  |   |                              |  |                    |            |
| <ul style="list-style-type: none"><li>To impart technological concepts of applied chemistry</li><li>To lay foundation for practical application of chemistry in engineering aspects</li></ul>  |   |                              |  |                    |            |
| <b>Course Outcomes:</b>  |   |                              |  |                    |            |
| <ul style="list-style-type: none"><li>Students will be familiar with the water purification, corrosion and its control, engineering applications of polymers, types of fuels and their applications, basic aspects of electrochemistry and energy storage devices.</li></ul> |   |                              |  |                    |            |
| <b>Student Outcomes (SO):</b>  |   | <b>A, b, e</b>               |  |                    |            |
| <b>Module No</b>   | <b>Module Description</b>   |                              |  | <b>Hrs.</b>        | <b>SO</b>  |
| <b>1</b>   | <b>Types of impurities in water</b> – Types of Hardness in boiler water. Alkalinity of water and its estimation; Estimation of hardness by EDTA method-Numerical problems; Scale, Sludge, Reasons for the formation of scale and Removal. Boiler water purification by ion-exchange resin method. Specifications for potable water – Drinking water treatment – Disinfection by chlorination, ozonisation and UV treatment; Sea water to drinking water conversion -Reverse osmosis & its significance  |                              |  | <b>5</b>           | <b>a,e</b> |
| <b>2</b>   | <b>Phase equilibria:</b> Gibbs phase rule, definition of terms with examples, One Component Systems- water and carbon dioxide systems – Reduced phase rule. Two Component eutectic System-lead-silver systems. Alloys: Introduction- Definition- Properties of alloys- Significance of alloying- Ferrous alloys- Nichrome and Stainless steel –   |                              |  | <b>5</b>           | <b>b,e</b> |
| <b>3</b>   | <b>Electrochemistry - Corrosion:</b> Introduction to Electrochemical reactions; Redox-reactions; Nernst equation; Problem solving using Nernst equation. Standard Reduction Potentials; Cell potentials and Free Energy, Types and Mechanism of corrosion Galvanic Corrosion; Determination of spontaneity of Corrosion, Relationship between corrosion and entropy, enthalpy and free energy. <b>Corrosion prevention;</b> Cathodic protection – sacrificial anodic and impressed current protection methods; Electrolysis-electroplating-process and typical applications, metal cladding; Coating processes – PVD and CVD and applications – |                              |  | <b>8</b>           | <b>a,b</b> |
| <b>4</b>   | <b>Energy conversion and storage:</b> Fuel cells – Electrochemistry of a H <sub>2</sub> -O <sub>2</sub> fuel cell, Basics of solid oxide fuel cells-applications; Limitations of Batteries. <b>Batteries- Chemical change and</b>   |                              |  | <b>8</b>           | <b>a</b>   |

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|   | <b>Electrical Work;</b> Electrochemical reactions; Primary cells: Lechlanche, alkaline and Li-primary cells. Secondary cells - Lead – acid, Ni-Cd, Ni-MH cells; Rechargeable lithium cells – LiCoO <sub>2</sub> and LiC <sub>6</sub> chemistry and applications.  |    |     |
| 5   | <b>Energy sources:</b> Fuels-Definition. Calorific value - Definition of LCV, HCV. Measurement of calorific value using bomb and Boy's calorimeter – problem solving. Coal analysis-proximate and ultimate analysis and significance. Stoichiometric combustion reactions of C, CH <sub>4</sub> etc. Calculation of minimum quantity of air by volume and by weight-Numerical problems. Knocking and chemical structure, octane number and cetane number and their importance; Alternate fuels and Fuel additives. Biodiesel-synthesis, advantages and commercial applications;   | 8  | a,b |
| 6   | <b>Industrial and Conducting polymers</b> : Introduction to Polymers- Classification. Types of Polymerization (Chain & Step growth); Properties and engineering applications of BS, PVC, PMMA, PET, Teflon and Bakelite. Compression, injection, extrusion, Transfer moulding methods of plastics. Fiber reinforced composites - Properties and applications in automobiles and aerospace. Second Law of thermodynamics and entropy in recycling of plastics like PMMA. Introduction to metallic conductors. Conducting polymers: Polyacetylene and Polyaniline - Mechanism of Conduction, doping, Electrical characterization, applications of conducting polymers in semiconductor field. | 9  | a,b |
| 7   | Discussion on current development in a particular topic or Guest Lecture on Contemporary Topics   | 2  | e   |
|   | <b>Total Lecture:</b>   | 45 |     |
| <b>Text Books:</b>                            |   |    |     |
| 1.  | O. G. Palanna, <b>Engineering Chemistry</b> , Tata McGraw-Hill Education, 2009.   |    |     |
| 2.  | Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010  |    |     |
| <b>Reference Books:</b>                       |   |    |     |
| 1.  | Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010   |    |     |
| 2.  | O.V. Roussak and H.D. Gesser, <i>Applied Chemistry-A Text Book for Engineers and Technologists</i> , Springer Science Business Media, New York, 2 <sup>nd</sup> Edition, 2013.  |    |     |
| 3   | R. Gowarikar and N.V. Viswanathan and J. Sreedhar, <i>Polymer Science</i> , John Wiley & Sons, 2007.  |    |     |
| 4   | Peter Atkins and Julio De Paula, <i>Atkins' Physical Chemistry</i> , Oxford University Press, 2011.   |    |     |
| 5   | David Linden, <i>Hand Book of batteries</i> , McGraw Hill Publishers, 4 <sup>th</sup> Edition, 2010.  |    |     |
| 6   | Brown and Holme, <i>Chemistry for Engineering Students</i> , 3rd Edition, Cengage, 2015.  |    |     |
| 7   | Dr. Eliezer Gileadi , <i>Electro kinetics for Chemist and chemical engineers</i> , Wiley-VCH, 1993, ISBN-10: 0471188581 , ISBN-13: 978-0471188582   |    |     |
| <b>Indicative list of Experiments - SO- i</b> |   |    |     |

1. Determination of total hardness of water by EDTA method.
2. Estimation of different types of alkalinity in waste water sample.
3. Estimation of Copper in an alloy by Iodometry.
4. Estimation of Iron in an alloy by Cerimetry
5. Determination of dissolved oxygen content in the Treated water sample
6. Assessment of Chemical Oxygen Demand (COD) and BOD of waste water.
7. Assessment of TDS in water samples using TDS-Conductivity method.
8. Determination of concentration of alkali metal ions (Na or K) by flame photometry
9. Analysis for percentage of Iron in steel by redox potentiometry
10. Assay of Nickel through soluble complex formation by colorimetry
11. Chloride level detection in municipal water using  $\text{AgNO}_3$  by conductometry.
12. Estimation of the molecular weight of a polymer by Ostwald Viscometer.

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| <i>Recommendation by the Board of Studies on</i> | 22-04-2017        |
| <i>Approval by Academic council on:</i>          | 07-09-2017        |
| <i>Compiled by:</i>                              | Dr.S. Arockiasamy |

LTPC : L = Lecture, T = Tutorial, P = Practical