

## ENGINEERING CHEMISTRY

<b>I Semester:</b> AE   CIVIL   CSE   ECE   EEE   IT   ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AHS005	Core	L	T	P	C	CIA	SEE	Total
		3	-	2	3	30	70	100
<b>Contact Classes: 45</b>		<b>Tutorial Classes: Nil</b>		<b>Practical Classes: 2</b>			<b>Total Classes: 45</b>	
<b>OBJECTIVES:</b>								
<b>The course should enable the students to:</b>								
I. Apply the electrochemical principles in batteries.								
II. Understand the fundamentals of corrosion and development of different techniques in corrosion control.								
III. Analysis of water for its various parameters and its significance in industrial, applications.								
IV. Improve the fundamental science and engineering principles relevant to materials.								
<b>COURSE LEARNING OUTCOMES (CLOs):</b>								
1. Extrapolate the knowledge of electrolytic cell, electrochemical cell, electrode potential and reference electrodes.								
2. Use of primary and secondary batteries in various fields such as automobiles, railways, medical devices, aircrafts and day to day life.								
3. Explain the characteristic factors of a metal and environment influencing the rate of corrosion.								
4. Use appropriate methods such as protective, metallic and organic coatings to control corrosion in metals.								
5. Evaluate the quality and utility of suitable water for industrial as well as domestic applications.								
6. Use innovative methods to improve the quality of soft water for Potable and industrial purpose at cheaper cost.								
7. Understand the concepts of polymers for viscoelastic nature of polymer materials in real-time application.								
8. Demonstrate the ability to use polymeric materials for engineering problems in different domains.								
9. Justify the immense importance of basic constructional material, Portland cement in civil engineering works.								
10. Describe various instruments used for measuring various properties of lubricants in industries.								
11. Understand refractory use in metallurgical furnaces, kilns and other equipments.								
12. Demonstrate comprehensive knowledge of conventional fuel properties on engine performance.								
13. Understand the importance of cracking, knocking in IC engines and operations involved in								

<p>petroleum refining for real-time application.</p> <p>14. Describe the physical and chemical properties of alternate fuels like natural gas, LPG and CNG.</p> <p>15. Determine efficiency of the fuel in terms of calorific value and combustion reactions of the fuel.</p> <p>16. Understand the concepts of electro chemistry in solar cell, Fuel cells and batteries for real-time application.</p> <p>17. Understand the concepts of corrosion control methods in pipeline leaks and ruptures as real-time application.</p> <p>18. Understand the concepts of water technology in applications of image recognition for real-time water level and surface velocity.</p>		
<b>Unit-I</b>	<b>ELECTROCHEMISTRY AND BATTERIES</b>	<b>Hours: 15</b>
<p>Electrochemistry: Basic concepts of electrochemistry; Conductance: Specific, equivalent and molar conductance and effect of dilution on conductance; Electrochemical cells: Galvanic cell (daniel cell); Electrode potential; Electrochemical series and its applications; Nernst equation; Types of electrodes: Calomel electrode, quinhydrone electrode; Batteries: Classification of batteries, primary cells (dry cells) and secondary cells (lead-acid battery, Ni-Cd cell), applications of batteries, numerical problems.</p>		
<b>Unit-II</b>	<b>CORROSION AND ITS CONTROL</b>	<b>Hours: 12</b>
<p>Corrosion: Introduction, causes and effects of corrosion; Theories of corrosion: Chemical and electrochemical corrosion with mechanism; Factors affecting the rate of corrosion: Nature of the metal and nature of the environment; Types of corrosion: Waterline and crevice corrosion; Corrosion control methods: Cathodic protection- sacrificial anodic protection and impressed current cathodic protection; Surface coatings: Metallic coatings, methods of application of metallic coatings-hot dipping(galvanizing, tinning), electroplating(copper plating); Organic coatings: Paints, its constituents and their functions.</p>		
<b>Unit-III</b>	<b>WATER TECHNOLOGY</b>	<b>Hours: 09</b>
<p>Water: Sources and impurities of water, hardness of water, expression of hardness-units; Types of hardness: Temporary hardness, permanent hardness and numerical problems; Estimation of temporary and permanent hardness of water by EDTA method; Determination of dissolved oxygen by Winkler's method; Boiler troubles: Priming, foaming, scales, sludges and caustic embrittlement.</p> <p>Treatment of water: Internal treatment of boiler feed water- carbonate, calgon and phosphate conditioning, softening of water by Zeolite process and Ion exchange process; Potable water-its specifications, steps involved in the treatment of potable water, sterilization of potable water by chlorination and ozonization, purification of water by reverse osmosis process.</p>		
<b>Unit-IV</b>	<b>MATERIALS CHEMISTRY</b>	<b>Hours: 15</b>
<p>Materials chemistry: Polymers-classification with examples, polymerization-addition, condensation and co-polymerization; Plastics: Thermoplastics and thermosetting plastics; Compounding of plastics; Preparation, properties and applications of polyvinyl chloride, Teflon, Bakelite and Nylon-6, 6; Rubbers: Natural rubber its process and vulcanization; Elastomers: Buna-s and Thiokol rubber; Fibers: Characteristics of fibers, preparation properties and applications of Dacron; Characteristics of fiber</p>		

reinforced plastics; Cement: Composition of Portland cement, setting and hardening of Portland cement; Lubricants: Classification with examples; Properties: Viscosity, flash, fire, cloud and pour point; Refractories: Characteristics and classification with examples.		
<b>Unit-V</b>	<b>FUELS AND COMBUSTION</b>	<b>Hours: 09</b>
Fuel: Definition, classification of fuels and characteristics of a good fuels; Solid fuels: Coal; Analysis of coal: Proximate and ultimate analysis; Liquid fuels: Petroleum and its refining; Cracking: Fixed bed catalytic cracking; Knocking: Octane and cetane numbers; Gaseous fuels: Composition, characteristics and applications of natural gas, LPG and CNG; Combustion: Calorific value: Gross Calorific Value(GCV) and Net Calorific Value(NCV), calculation of air quantity required for complete combustion of fuel, numerical problems.		
<b>Text Books:</b>		
<ol style="list-style-type: none"> <li>1. P. C. Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company, 15<sup>th</sup> Edition, 2015.</li> <li>2. Shashi Chawla, "Text Book of Engineering Chemistry" Dhanat Rai and Company, 1<sup>st</sup> Edition 2011</li> </ol>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. B. Siva Shankar, "Engineering Chemistry", Tata McGraw Hill Publishing Limited, 3<sup>rd</sup> Edition, 2015.</li> <li>2. S. S. Dara, Mukkanti, "Text of Engineering Chemistry", S. Chand &amp; Co, New Delhi, 12<sup>th</sup> Edition, 2006.</li> <li>3. C. V. Agarwal, C. P. Murthy, A. Naidu, "Chemistry of Engineering Materials", Wiley India, 5<sup>th</sup> Edition, 2013.</li> <li>4. R. P. Mani, K. N. Mishra, "Chemistry of Engineering Materials", Cengage Learning, 3<sup>rd</sup> Edition, 2015.</li> </ol>		
<b>Web References:</b>		
<ol style="list-style-type: none"> <li>1. <a href="http://www.tndte.com">www.tndte.com</a></li> <li>2. <a href="http://nptel.ac.in/downloads">nptel.ac.in/downloads</a></li> <li>3. <a href="http://www.scribd.com">www.scribd.com</a></li> <li>4. <a href="http://cuiet.info">cuiet.info</a></li> <li>5. <a href="http://www.sbtebihar.gov.in">www.sbtebihar.gov.in</a></li> <li>6. <a href="http://www.ritchennai.org">www.ritchennai.org</a></li> </ol>		
<b>E-Text Books:</b>		
<ol style="list-style-type: none"> <li>1. <a href="http://Corrosion.ksc.nasa.gov/electrochem_cells.htm">Corrosion.ksc.nasa.gov/electrochem_cells.htm</a></li> <li>2. <a href="http://www.science.uwaterloo.ca/~cchieh/cact/applychem/watertreatment.html">www.science.uwaterloo.ca/~cchieh/cact/applychem/watertreatment.html</a></li> <li>3. <a href="http://www.acs.org/content/acs/en/careers/college-to-career/areas-of-chemistry/polymer-chemistry.html">www.acs.org/content/acs/en/careers/college-to-career/areas-of-chemistry/polymer-chemistry.html</a></li> <li>4. <a href="http://www.darvill.clara.net/altenerg/fossil.htm">www.darvill.clara.net/altenerg/fossil.htm</a></li> <li>5. <a href="http://Library.njit.edu/research_helpdesk/subject_guides/chemistry.php">Library.njit.edu/research_helpdesk/subject_guides/chemistry.php</a></li> </ol>		