

  
**BMS COLLEGE OF ENGINEERING, BENGALURU-19**  
 Autonomous Institute, Affiliated to VTU  
 Scheme & Syllabus for UG Programme – I & II Semesters 2017-18

<b>Course Code</b>	<b>14CY1ICCHY / 14CY2ICCHY</b>	<b>Course Name</b>	<b>Engineering Chemistry</b>
<b>Credits</b>	<b>05</b>	<b>L-T-P-S</b>	<b>4-0-1-0</b>

**MODIFIED COURSE OUTCOMES – Engineering Chemistry (17CY1/2 ICCHY)**

<b>CO 1</b>	Learn and understand Principles of Engineering Chemistry involved in water treatment, conventional electrochemical and renewable sources of energy, polymers corrosion and its control.
<b>CO 2</b>	Ability to describe and address problems based on the learnt Principles.
<b>CO 3</b>	Apply the acquired knowledge to analyse and draw meaningful inferences from the experimental results

**SYLLABUS:**

**UNIT-1. Water Treatment**

Introduction, hardness of water, units of hardness, determination of hardness by EDTA method, disadvantages of hard water – boiler scales, boiler corrosion and caustic embrittlement, qualities of drinking water, treatment of water for municipal supply, desalination of water – reverse osmosis and electro dialysis, waste water – COD and BOD, treatment of waste water – primary, secondary and tertiary treatment methods, Principle and experimental determination of COD of waste water, estimation of dissolved alkali and alkaline earth metals in water by flame photometry, applications of nanotechnology in water treatment, problems 09 hours

**UNIT-2. Electrochemical Energy Systems**

- a) Electrode potential and cells** – Introduction, classification of cells-primary, secondary and concentration cells, reference electrodes–calomel electrode and Ag/AgCl electrode, ion-selective electrode- glass electrode, determination of pH using glass electrode, applications of these electrodes in determining strength of acids, bases and red-ox reactions, numerical problems
- b) Batteries** - Basic concepts, battery characteristics, classification of batteries– primary, secondary and reserve batteries, modern batteries - construction, working and applications of zinc–air, nickel-metal hydride and Li-MnO<sub>2</sub> batteries
- c) Fuel cells** - Introduction, types of fuel cells - alkaline, phosphoric acid, molten carbonate, solid polymer electrolyte and solid oxide fuel cells, construction and working of methanol-oxygen fuel cell 10 hours

### **UNIT-3. Chemical Fuels and Photovoltaic Cells**

**a) Chemical fuels** - Definition, classification, calorific value-definition, gross and net calorific values, determination of calorific value of a solid / liquid fuel using Bomb calorimeter and problems on calorific value, petroleum cracking - fluidized bed catalytic cracking, reformation of petrol, octane number, cetane number, knocking – mechanism, prevention of knocking, anti-knocking agents, unleaded petrol, synthetic petrol – Fischer- Tropsch's process, power alcohol , biodiesel and hydrogen as a fuel

**b) Photovoltaic cells** – Production of solar grade silicon, physical and chemical properties of silicon relevant to photovoltaics, doping of silicon, construction and working of a PV- cell and uses. 09 hours

### **UNIT-4. Corrosion Science and Metal Finishing**

**a) Corrosion** – Definition of chemical corrosion, electrochemical theory of corrosion, types of corrosion - differential metal, differential aeration corrosion (pitting and water line corrosion), stress corrosion, factors affecting the rate of corrosion, corrosion control: inorganic coatings – anodizing and phosphating, metal coatings – galvanization and tinning, corrosion inhibitors, cathodic protection

**b) Metal finishing** - Technological importance of metal finishing, significance of polarization, decomposition potential and over-voltage in electroplating processes. Electroplating – Process, effect of plating variables on the nature of electro - deposit, surface preparation, electroplating of Cr and Au, estimation of copper in the effluent of electroplating industries by colorimetric method. Electroless plating - Distinction between electroplating and electroless plating, advantages of electroless plating, electroless plating of copper on PCB. 10 hours

### **UNIT-5. Polymer Chemistry**

**Polymers** - Introduction, mechanism of coordination polymerization (Zeigler - Natta polymerization), methods of polymerization – bulk, solution, suspension and emulsion polymerization, glass transition temperature, structure and property relationship of polymers, number average molecular weight, weight average molecular weight and their determination.

**a) Plastics** - Definition of resins and plastics, compounding of resins to plastics, synthesis, properties and applications of PMMA and UF.

**b) Elastomers** - Synthesis and application of butyl rubber and nitrile rubber

**c) Adhesives** - Preparation and applications of epoxy resins

**d) Polymer composites**, Wood polymer composites (WPC), Nano composites-composition, effect of size on properties and uses

**e) Conducting polymers** – Definition, structure, properties and mechanism of conduction in poly aniline and uses. 10 hours

## REFERENCES

### Text Books:

1. A Text book of Engineering Chemistry–by Jain and Jain, Dhanapatrai Publications, New Delhi, 2011
2. Engineering Chemistry by Gadag and Nityananda Shetty, I.K International publishing House Pvt. Ltd, 2010

### Reference Books:

1. Puri B R Sharma L R and Madan S Pathania, Principles of Physical Chemistry, Vishal publishing Co., Edition 2004
2. Kuriocose, J C and Rajaram, J, Engineering Chemistry, Volume I/II, Tata McGraw- Hill Publishing Co. Ltd. New Delhi, 2000
3. Engineering Chemistry Lab Manual, written by faculty, Dept. of Chemistry, BMSCE, Bangalore.

### e-books:

1. Introduction to Chemistry - Tracy Poulsen; 250 pages; ISBN-13: 9781478298601; ISBN-10: 147829860X
2. Elementary Applied Chemistry\* - Lewis Benajah Allyn; 152 pages; Publisher: Ginn and Company 1912; ISBN/ASIN: 1112247610

### MOOCs:

1. <http://www.mooc-list.com/course/chemistry-minor-saylororg>
2. <https://www.canvas.net/courses/exploring-chemistry>

### List of Experiments

- 1 Determination of percentage of copper in brass using standard sodium thiosulphate solution
- 2 Determination of total hardness of a sample of water using disodium salt of EDTA
- 3 Determination of chemical oxygen demand (COD) of the given industrial waste water sample
- 4 Estimation of sodium in water by flame photometric method
- 5 Conductometric estimation of HCl + CH<sub>3</sub>COOH using standard NaOH solution
- 6 Potentiometric estimation of FAS using standard K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> solution
- 7 Determination of pK<sub>a</sub> of a weak acid using pH meter
- 8 Determination of calorific value of a solid fuel using Bomb calorimeter
- 9 Determination of percentage of iron in the given rust solution (using potassium dichromate) by external indicator method
- 10 Estimation of copper from the effluent of electroplating industry by colorimetric method
- 11 Determination of molecular weight of a polymer using Ostwald's viscometer

**ASSESSMENT:** Assessment is made by conducting three tests, one-Quiz and Laboratory External Exam. for arriving at CIE marks as shown below:

<b>CIE IN THEORY (25 marks)</b>				
Test	Marks			
Test -1	40	Taken best of 2 test marks	Add two best marks scored of three test (40+40) and Quiz (20 marks) Total: 40+40+20=100	<b>Reduced to 25 marks</b>
Test – 2	40			
Test – 3	40			
Quiz	20			
<b>CIE IN LABORATORY (25 marks)</b>				
Lab. Observation book	10 Experiments 10marks each	Total marks= 100	Total marks for Observation and Record= 200 Reduced to 10 (A)	<b>Total: (A) +(B) = 25</b>
Lab. Record book	10 Experiments 10 marks each	Total marks= 100		
Final Test in the Lab.	Exam conducted for 50 marks	Reduced to 15 (B)		

**Total CIE marks (Both Theory & Lab) = 25 + 25= 50**