



THE NATIONAL INSTITUTE OF ENGINEERING

(An Autonomous Institution; Affiliated to the VTU)
MANANTHODY ROAD, MYSORE-570008

DEPARTMENT OF CHEMISTRY

I/II semester B.E. Engineering Chemistry Syllabus 2020-21

Sub Code: CH1C01/ CH2C01
Hrs/Week: 03 / Credits: 03
SEE Hrs: 3 Hrs:

CIE: 50% Marks
SEE: 50% Marks
Max Marks: 100

Course outcomes:

On successful completion of the course, the students will be able to,

1. Explain the basic concept of batteries & fuel cells and their applications.
2. Apply the knowledge in corrosion science to control corrosion problems.
3. Identify various methods to enhance the quantity & quality of gasoline.
4. Apply the knowledge of different methods for water analysis and purification.
5. Explain the processing of high polymers & their applications.

MODULE-1

Battery Technology

Introduction - Galvanic cell, electrode potential, EMF of the cell and cell representation. Batteries and their importance, Classification of batteries- primary, secondary and reserve batteries with examples. Battery characteristics - voltage, capacity, energy density, power density, energy efficiency, cycle life and shelf life. Basic requirements for commercial batteries. Construction, working and applications of: Zn-Ag₂O, Ni-Cd, Zn-air and Lithium ion battery.

Fuel Cells- Differences between battery and a fuel cell, Classification of fuel cells - based on type of fuel, electrolyte and temperature. Construction, working and applications of solid oxide fuel cell.

SLE: Supercapacitors: Definition, types and characteristics.

8 Hrs

MODULE-2

Corrosion and its Control

Introduction, Electrochemical theory of corrosion with respect to iron. Factors influencing the corrosion rate: physical state of the metal, nature of the metal, area effect, over voltage, pH, temperature and nature of the corrosion product. Types of corrosion: galvanic series; (i) Differential aeration corrosion- oxygen concentration cell, (ii) Stress corrosion- explanation-caustic embrittlement. Corrosion control by: i) Using inhibitors, ii) Cathodic protection- sacrificial anode and impressed current methods iii) Protective coatings-metal coatings- galvanizing and tinning.

SLE: Galvanic corrosion, Water line corrosion and seasonal cracking.

8 Hrs

MODULE-3

Chemical fuels

Introduction, classification with examples, calorific value-classification (HCV & LCV), determination of calorific value of solid and liquid fuels using Bomb calorimeter-numerical problems. Petroleum cracking -fluidized bed catalytic cracking. Reformation of petrol-explanation with reactions, Knocking in IC engine, its ill effects and prevention of knocking. Anti-knocking agent: Leaded and unleaded petrol. Power alcohol and its advantages. Synthetic petrol - Bergius process.

Solar energy- Photo voltaic cells- definition, working and importance of PV cells. Production of solar grade silicon by chemical vapor deposition.

SLE: Octane number, cetane number. Purification of silicon by zone refining technique.

8 Hrs

MODULE-4

Water technology

Introduction, water analysis: i. Hardness-determination by EDTA method-numerical problems, ii. Alkalinity-determination by double indicator method-numerical problems, iii. Determination of dissolved oxygen by Winkler's method and iv. Determination of chemical oxygen demand - numerical problems. Boiler scales-formation and ill effects, prevention of scales by external method (hot lime-soda process). Desalination by electrodialysis.

SLE: Determination of chloride by Mohr's method. Prevention of boiler scales by internal methods: Calgon and Phosphate conditioning.

8 Hrs

MODULE-5

High polymers for engineering applications

Introduction, Polymerization techniques - bulk, solution, suspension and emulsion polymerization. Glass transition temperature (T_g)-meaning - factors affecting T_g (crystallinity, effect of side groups, molecular weight & plasticizers) and significance. Preparation, properties and applications of Kevlar, Polyurethane, and Epoxy resin; Determination of molecular weight of polymers by number average and weight average method-numerical problems. Conducting polymers - mechanism of conduction in polyacetylene and applications.

SLE: Classification of polymers based on occurrence, thermal behavior, type of polymerization and chemical structure.

7 Hrs

(Note: SLE – Self Learning Exercise)

Text Books

1. Text book of Engineering Chemistry by Dr. K. Pushpalatha, published by Wiley publications 2nd edition.
2. A text book of Engineering Chemistry 15th Edition by P. C. Jain and Monica Jain, Dhanpat Rai Publishing Co (P) Ltd., New Delhi.
3. Text book of Engineering Chemistry by S.S. Dara, published by Chand and Co., 2009.

Reference Books

1. Principles of Physical Chemistry by B. R. Puri, L. R. Sharma and M. S. Pathania, S. Nagin Chand and Co.
2. Text book of Physical Chemistry by Soni and Dharmatha, S. Chand & Sons.
3. Text book of Polymers science by Gowarikar and Vishwanathan.
4. Corrosion Engineering by M. G. Fontana, Mc Graw Hill Publications.

**ENGINEERING CHEMISTRY LAB
I/II SEMESTER**

Sub Code: CH1L01/CH2L01
Max Marks: 50

Hrs/Week: 03 Hrs
Credit: 1.5

Course outcomes:

On successful completion of the course, the students will be able to,

1. Perform accurate quantitative measurements and equipment handling.
2. Analyze the data and interpret result to arrive at a conclusion.

PART-A

1. Estimation of total hardness in water by EDTA method.
2. Estimation of sodium thiosulphate by Iodometric method.
3. Estimation of percentage of copper in brass.
4. Estimation of Iron in the Haematite ore by external indicator method.
5. Determination of Chemical Oxygen Demand (COD) of the given industrial waste water sample.
6. Determination of Calcium Oxide (CaO) in the given sample of cement by Rapid EDTA method.

PART-B

1. Estimation of Mohr's salt by Potentiometric titration.
2. Estimation of an acid (weak/strong) by Conductometric titration.
3. Determination of pKa value of a weak acid using pH meter.
4. Estimation of copper by using Colorimeter.
5. Determination of viscosity coefficient of a given liquid using Ostwald's viscometer.
6. Estimation of Iron by using Colorimeter.

(Note: Any ten experiments may be conducted)

Reference Books

1. Vogels textbook of quantitative inorganic analysis, revised by J.Bassett, R.C.Denny, G.H.Jeffery, 4th Ed.