

**B.E Syllabus- Engineering Chemistry 1st Year Theory & Lab 2021-22**

Course code	Course title				Core/Elective		
<b>BS204CH</b>	<b>ENGINEERING CHEMISTRY (Common for All Branches)</b>				<b>Core</b>		
Pre-requisites	Contact Hours Per Week				CIE	SEE	Credits
-	L	T	D	P			
	3	1	-	-	40	60	4

**Course Objectives:**

1. Correlate the properties of materials with their internal structure and use for Engineering applications.
2. Apply the principals of electrochemistry in storage of electrical energy in batteries.
3. Gains knowledge in causes of corrosion and its prevention.
4. Attains knowledge about the disadvantages of hard water for domestic and industrial purposes.
5. Also learns the techniques of softening of hard water and treatment of water for drinking purpose.
6. Exposed to qualitative and quantitative parameters of chemical fuels.
7. Aware eco-friendly materials and processes.

**Course Outcomes:**

**On successful completion of this course, students will be able to:**

1. Apply concept of electrode potential in identifying feasibility of electrochemical reaction; illustrate electro analytical techniques and working of batteries.
2. Identify the mechanism of corrosion of materials on basis of electrochemical approach and devise corrosion control methods.
3. Estimate the physical & chemical parameters of quality of water and explain the process of water treatment.
4. Explain the influence of chemical structure on properties of materials and their choice in engineering applications.
5. Classify chemical fuels and grade them through qualitative analysis.
6. Relate the concept of green chemistry to modify engineering processes and materials.

**UNIT-I Electrochemistry and Battery Chemistry: Electrochemistry:** Electrochemical cells, Electrolytic and Galvanic cells-notation, cell reaction and cell potentials. Types of electrodes, Calomel Quinhydrone and Glass electrodes. Determination of pH of a solution by using Quinhydrone electrode. Thermodynamics of emf of cells, Nernst equation and its derivation. Applications of Nernst equation to electrode potential and emf of cells. Numerical problems.

**Batteries: Primary batteries:** Zn - Carbon battery. **Secondary batteries:** Pb-Acid battery and Li-Ion battery, Applications.

**Flow batteries (Fuel cells):** Methanol-Oxygen fuel cells, Construction, Applications.

**UNIT-II Water Chemistry and Corrosion: Water Chemistry:** Hardness of Water-Types and units of hardness, estimation of temporary and permanent hardness of water by EDTA method. Alkalinity of water and its determination. Water softening by Ion exchange and Reverse Osmosis methods. Numerical problems. Specifications of potable water. Sterilization by Chlorination. Break Point Chlorination.

**Corrosion:** Causes and its effects. Types of Corrosion-Dry or Chemical corrosion and Wet or Electrochemical corrosion and their mechanism. Electrochemical corrosion –Waterline and Pitting Corrosion. Factors influencing rate of corrosion. **Corrosion control methods:** Cathodic protection methods - Sacrificial anodic and impressed current methods. **Surface coating methods:** Hot Dipping-Galvanizing.

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**UNIT-III Engineering Materials: Polymers:** Basics of terms polymers: Monomer and its functionality, Polymers and degree of polymerization. Classification of polymers - Thermoplastics & Thermosetting resins. Types of Polymerization (i) Addition (ii) Condensation (iii) Co-Polymerization. Mechanism of free radical polymerization.

**Preparation, Properties & Uses of the following polymers:** Plastics - PVC and Bakelite, Fibers - Nylon 6:6, and Kevlar, Elastomers - Buna-S, Butyl and Silicone Rubbers.

**Conducting polymers:** Introduction, Classification and Mechanism of conduction in Poly-acetylene, Applications of conducting polymers.

**Biodegradable polymers:** Introduction preparation, properties and applications of polylactic acid.

**UNIT-IV Chemical Fuels:** Classification of fuels: Introduction, definition and classification of chemical fuels- Primary and secondary fuels. Solid, liquid and gaseous fuels. Requirements of a good fuel. Calorific Value – HCV and LCV. Theoretical calculations of calorific value by Dulong’s formula – Numerical problems. **Solid Fuels:** Coal and its Ranking. Analysis of coal - Proximate and Ultimate analysis. **Liquid Fuels:** Fractionation of Petroleum. Composition and uses of Gasoline, Diesel and Kerosene. Cracking & its Significance- Catalytic cracking by moving bed method. **Knocking:** Fuel rating – Octane and Cetane numbers. **Gaseous Fuels:** LPG, CNG -Composition and Uses. **Combustion:** Ignition temperature of a fuel, calculation of air quantities by weight and volume required for combustion of a fuel- Numerical problems.

**UNIT-V Green Chemistry and Composites: Green Chemistry:** Concept, Principles of green chemistry – Atom Economy, Catalysis. and examples of clean technology. **Biodiesel:** Sources, Concept of Trans esterification and carbon neutrality. Properties and significance. **Composites:** Introduction to composites, composition and characteristic properties of composites. Classification of composites based on matrix, reinforcement and ply. Applications of composites.

**Text books:**

P.C. Jain & M. Jain, Engineering Chemistry, Dhanpatrai and sons Publishing Company, 17<sup>th</sup> Edn, New Delhi (2010).

Rama Devi, Venkata Ramana Reddy and P.Rath, Engineering Chemistry, Cengage Learning, New Delhi (2016).

S.S.Dara, S. Chand, A Text Book of Engineering Chemistry, S.Chand Publications, Reprint edition, 2017.

Puri and Sharma, Principles of Physical Chemistry, Vishal Publications Co.2019

Agarwal Shikha, Engineering Chemistry, Cambridge University Publications 2015.

**Reference Books:**

C. V. Agarwal, C. P. Murthy, A. Naidu, “Chemistry of Engineering Materials”, Wiley India, 5<sup>th</sup> Edition, 2013.

R. P. Mani, K. N. Mishra, “Chemistry of Engineering Materials”, Cengage Learning, 3<sup>rd</sup> Edition, 2015.

Shashi Chawla, Engineering Chemistry, Dhanpatrai and Company Ltd, Delhi (2015)

S.S Dara, Dr.K Mukkanti, A text book of Engineering Chemistry ,S Chand 2010.

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<b>BS204CH</b>	<b>ENGINEERING CHEMISTRY LAB (Common for All Branches )</b>				<b>Core</b>		
Pre-requisites	Contact Hours Per Week				CIE	SEE	Credits
-	L	T	D	P	25	50	1.5
-	-	-	-	3			

**Course Objectives:**

1. Conduct experiments, take measurements and analyze the data through hands-on experience in order to demonstrate understanding of the theoretical concepts of quantitative analysis while working in small group.
2. Interpret the electro analytical principles with experimental results graphically.
3. Demonstrate writing skills through clear laboratory reports.

**Course Outcomes:**

1. Estimation of hardness of water.
2. Estimation of mobility of ions in strong acids and weak acids using conductivity meter.
3. Measure the electrode potential of a given solution.
4. Apply the principles of Colorimetry and Electrochemistry in quantitative estimations.
5. Estimation of the rate constant of a reaction.
6. Synthesis of drug.

**List of Experiments:**

1. Introduction to Chemical Analysis.
2. Techniques of Weighing.

**Volumetric Analysis:**

3. Preparation of Standard Mohr's salt solution, Standardization of KMnO<sub>4</sub> and estimation ferrous ion.
4. Estimation Iron (II) by Dichromatometry.

**Water Analysis:**

5. Preparation of Standard Magnesium sulphate solution, standardization of EDTA and Estimation of Total Hardness.
6. Preparation of Standard Sodium Carbonate Solution, Standardization of HCl and Estimation of Carbonate and Bicarbonate by Alkalinity.

**Conductometry:**

7. Estimation of HCl.
8. Estimation of CH<sub>3</sub>COOH and mixture of acids.

**Potentiometry:**

9. Estimation of HCl.
10. Estimation of Iron.

**pH Metry:**

11. Estimation of HCl.

**Colorimetry:**

12. Verification of Beer-Lambert's law and estimation of Manganese.

**Chemical Kinetics:**

13. Determination of rate constant of acid catalyzed hydrolysis of methyl acetate.

**Drug Synthesis:**

Preparation of Aspirin.

**Note: Minimum ten experiments should be conducted in the semester**

**Textbooks:**

1. B.D. Khosla, A. Gulati and V.Garg, \_Senior Practical Physical Chemistry, (R. Chand & Co., Delhi)
2. K. K. Sharma and D.S. Sharma, An Introduction to Practical Chemistry, Vikas publishing, New Delhi.