ENGINEERING CHEMISTRY (THEORY)

Common for all branches

(With effect from admitted batch 2015-16)

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Course Objectives

- To provide knowledge on problems associated with impure water and various water treatment technologies
- To know the importance of semiconducting materials and preparation techniques
- To provide basic knowledge on conventional energy resources, developments in batteries and fuel cells
- To understand the corrosion of metals, various methods to prevent and control of corrosion
- To create awareness on advanced concepts like nano materials, green chemistry and eco-friendly technologies for future development

Course Outcomes

By the end of the semester, the student will be able to:	
CO-1	Identify the problems associated with raw water in various applications and can adopt suitable technologies for domestic and industrial feed waters.
CO-2	Identify & generalize the properties of semiconducting materials and can select suitable semiconducting & various ceramic materials for specific applications.
CO-3	Classify and analyze the conventional energy sources and design of suitable batteries/cells for different engineering applications.
CO-4	Select and design of suitable materials to prevent corrosion and protect various parts from corrosion.
CO-5	Implement the green chemistry principles, concept of tribology, unique properties of nano &composite materials in designing of suitable methods and materials to meet the technological challenges.
CO-6	Solve scientific problems related to various engineering fields.

SYLLABUS

UNIT I 10 Periods

Water Chemistry: Impurities in water, Hardness of water - units and calcium carbonate equivalents, -estimation of hardness (EDTA method) - disadvantages of hard water, boiler troubles- Scale& Sludge formation - prevention- Internal treatment - (Phosphate, Carbonate and Calgon conditioning) -Caustic embrittlement

Water treatment techniques: Softening of water -lime-soda process -numerical problems on LS process-Zeolite, -ion exchange methods, Desalination of water – Reverse osmosis and Eelectrodialysis, Municipal water treatment - Screening, sedimentation, coagulation, Sterilization- Chlorination-Break Point chlorination.

UNIT-II 10 Periods

Solid State Chemistry: Classification of Solids, Band theory of solids. Chemistry of Semiconductors – Intrinsic, extrinsic, compound and defect semiconductors, Organic semiconductors, Purification and preparation of Semiconductor by zone refining – Single crystal growth(Czochralski method) – epitaxial growth. Liquid crystals, LCD, LED and OLED.

Ceramic Materials: Cement-Manufacture of Portland cement - Setting and hardening of cement - Cement concrete - RCC, Refractories - Classification - properties, Ceramics and its Engineering applications.

UNIT – III 10 Periods

Thermal Energy: Fuel –types of fuels -Calorific value and its determination (Bomb calorimeter method) Coal- Ranking of coal - analysis (proximate and ultimate) – COKE – Manufacture (Otto Hoffmann's process). Petroleum – refining of Crude oil; Synthetic petrol – Fisher - Tropsch and Bergius methods, knocking in Petrol and Diesel engine – Octane number - Cetane number, LPG and CNG.

Chemical Energy: Electrode potential, electro chemical series – Reference electrodes – SHE, Calomel electrode – Galvanic cells – primary cells (Dry cell) secondary cells (Lead acid, Ni-Cd, Li ion batteries) H_2-O_2fuel cells.

Solar Energy: Construction and Working of Photovoltaic cell

UNIT IV 8 Periods

Corrosion Chemistry: Origin and theories of corrosion – Types of corrosion -Galvanic corrosion, concentration cell corrosion, pitting corrosion, stress corrosion, inter granular corrosion; Factors affecting corrosion – Corrosion

Prevention & Control of Corrosion: Cathodic protection; Corrosion inhibitors; Protective coatings –Galvanization & Tinning –Anodized coatings - paints & special paints

UNIT V 10 Periods

Nanochemistry: Introduction, growth of nanoparticles (Sol-gel process), Fullerenes and Carbon nanotubes

Green chemistry: Principles of Green chemistry, Alternative Solvents used in green synthesis.

Lubricants: Concept of Tribology -Mechanism of lubrication- Blended oils - properties of lubricating oils -Viscosity Index -Fire & Flash Point -Cloud &Pour Point -Aniline point.

High Polymers &Composites- Basic concepts of Polymers, Effect of polymer structure on properties. Plastics-Thermoplastic and Thermosetting resins, Composites -types- Fiber Reinforced Plastics -Particulate composites -Layer composites, engineering applications of composites.

Prescribed Text Book

1. Engineering Chemistry, 16th edition, P.C. Jain and M. Jain - DhanapathiRai& Sons, Delhi

Reference books

1. A tex*t* book of Engineering Chemistry, 15 th edition,S.S. Dara , S. Chand& Co. New Delhi
2. Engineering Chemistry, O.G.Palanna, Tata Mcgraw Hill Education pvt ltd, New Delhi.
3. Engineering Chemistry, B.K. Sharma - Krishna Prakashan, Meerut
4. Nanomaterials by A.K.Bandopadhayay, new age international publishers.
5. Green solvents for organic synthesis by V.K. Ahluvalia, Narosa publications.

ENGINEERING CHEMISTRY (LABORATORY)

Common for all branches

(With effect from admitted batch 2015-16)

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Course Objectives

- To enable the students to understand the basic concepts involved in quantitative analysis
- To improve skills in analyzing samples through titration procedures
- To know about methods of analyzing the ore samples
- To get an idea over instrumental methods of analysis for more accuracy

Course Outcomes

By the end of the semester, the student will be able to:	
CO-1	Apply experimental skills in quantitative chemical analysis of water quality parameters, substances and ores.
CO-2	Select and use a suitable instrumental technique for the quantitative estimation and analyse the data obtained.

List of Experiments

1. Preparation of standard solution
2. Estimation of sodium carbonate present in soda ash.
3. Estimation of amount of calcium present in the Portland cement by titrimetrically.
4. Estimation of amount of Copper present in the Copper ore by Iodometrically.
5. Determination of total Hardness present in the given water sample.
6. Estimation of amount of Zinc by titrating with EDTA.
7. Determine the strength of acid by titrating with strong base using **pH meter**.
8. Estimate the individual strength of acids present in the acid mixture by titrating with strong base using **conductivity meter.**
9. Estimate the amount of Mohr's salt present in the given solution by titrating with potassium dichromate using potentiometer.
10. Determination of viscosity of the given liquid by Ostwald viscometer.

11. Determination of rate constant of acid catalyzed hydrolysis of ester.

12. Determination of patrician coefficient of iodine distributed between Water and Carbon tetra chloride.

DEMONSTRATION

13. Estimation of amount of dissolved oxygen (D.O) present in the given water sample.

14. Synthesize the Phenol-Formaldehyde resin in the laboratory.

Prescribed Books

1. Laboratory manual on Engineering chemistry, third edition by S.K. Bhasin and SudhaRani, DhanpatRai Publishing Company.

Reference Books

1. Experiments and calculations in Engineering chemistry, 9^{th} edition by S.S. Dara, S. Chand& Company ltd.