

| Course Code | Course Name           | Hours per Week |   |   | Total | Total   |
|-------------|-----------------------|----------------|---|---|-------|---------|
|             |                       | L              | T | P | Hrs.  | Credits |
| EN3BS04     | Engineering Chemistry | 3              | 0 | 2 | 5     | 4       |

### Unit-I

Water and its Industrial Applications: Sources, Impurities, Hardness & its units, Industrial water characteristics, softening of water by various methods (External & Internal treatment), Boiler trouble causes, Effect & remedies, Characteristics of municipal water & its treatment, Numerical problems based on softening methods.

Water Analysis Techniques: Alkalinity, hardness (Complexometric), Chloride, Free chlorine, DO, BOD and COD, Numerical problems based on above techniques.

### Unit-II

Fuels & Combustion: Definition, Classification - Calorific Value (HCV and LCV) and Numerical Problems on Calorific Value -Combustion of Fuels, Numerical Problems on Combustion - Solid Fuels: Coal and Coke - Liquid Fuels: Petroleum and its Distillation, Cracking, Octane and Cetane Values of Liquid Fuels, Synthetic Petrol, Power Alcohol - Bio-Gas - Nuclear Fuels: Introduction to Fission and Fusion Reactions.

### Unit-III

Lubricants: Introduction, Mechanism of lubrication, Classification of lubricants, Properties and Testing of lubricating oils, Numerical problems based on testing methods.

Polymer: Introduction, Natural & Synthetic Rubber; Vulcanization of Rubber, Preparation, Properties & uses of the following- Polythene, PVC, Teflon, Nylon 6:6, Silicone Resin, Biopolymers, Biodegradable polymers, Biocomposites-Definition, types polymer matrix composites.

Corrosion: Definition, causes and types

### Unit-IV

Cement & Refractories: Manufacture, IS-code, Setting and hardening of cement. Refractory: Introduction, classification and properties of refractories.

New Engineering Materials: Superconductors, Organic Electronic Materials, Super conducting materials and its applications, Fullerenes, Optical Fiber, Nanomaterials-Introduction to nanochemistry-Carbon nanotubes, Nanowires and their applications

### Unit-V

Instrumental Techniques in Chemical Analysis: Introduction, Principle, Electromagnetic spectrum, quantization of energy, Electronic, vibrational and rotational energy levels, and transitions in atoms and molecules. Absorption and emission spectra.

Instrumentation and applications of IR, NMR, UV, Visible, Gas Chromatography, Lambert's and Beer's Law and its limitations.

Electrochemical Systems: Electrochemical cells and EMF, Applications of EMF measurements: Thermodynamic data, activity coefficients, solubility product and pH, corrosion.

**Text Books:**

1. P. C. Jain & Monika Jain, Engineering Chemistry, Dhanpat Rai Publications.
2. S. S. Dara, A Text Book of Engineering Chemistry, S. Chand & Company.
3. A.K. De, Environmental Chemistry, New Age International.
4. S. Chawla, Engineering Chemistry, Dhanpat Rai Publications.

**List of Practicals:**

Experiments on Volumetric Analysis:

1. To determine Hardness of given water sample by Complexometric titration.
2. To determine total and mixed Alkalinity of given water sample using phenolphthalein and methyl orange as indicator.
3. To determine strength of unknown FAS solution by redox titration using N-Phenyl anthranilic acid as internal indicator.
4. To determine strength of unknown  $\text{CuSO}_4$  solution by iodometric titration using Starch as internal indicator.
5. To determine Chloride content of water sample by Mohr's method (Argentometric titration).

**Fuel Testing:**

1. To determine moisture content in given sample of coal by proximate analysis.
2. To determine volatile content in given sample of coal by proximate analysis.
3. To determine ash content in given sample of coal by proximate analysis.
4. To determine percentage carbon content of coal by proximate analysis.
5. To determine penetration number of grease by Cone Penetrometer apparatus.
6. To determine flash and fire point of given oil sample by Cleveland's open cup apparatus.
7. To determine flash point of given oil sample by Penskey Marten's close cup apparatus.
8. To determine flash point of given oil sample by Abel's Close cup apparatus.
9. To determine Steam emulsification number of given lubricant.
10. To determine Aniline point of given oil sample.
11. To determine Cloud and Pour point of given lubricating sample.
12. To study rate of change of viscosity with temperature of the given lubricating oil by means of Redwood Viscometer no.1
13. To study rate of change of viscosity with temperature of the given lubricating oil by means of Redwood Viscometer no.2.

**Kinetics:**

1. Effect of concentration and temperature on the rate of reaction between sodium thiosulphate and hydrochloric acid.

**Electrochemistry:**

1. Variation of cell potential in  $\text{Zn}/\text{Zn}^{2+}/\text{Cu}^{2+}/\text{Cu}$  with change in concentration of electrolytes ( $\text{CuSO}_4$  or  $\text{ZnSO}_4$ ) at room temperature.