



- Notes :
1. All questions carry equal marks.
 2. Due credit will be given to neatness and adequate dimensions.
 3. Diagrams and Chemical equation should be given wherever necessary.
 4. Use of calculator is allowed.

1. The analytical results of raw water and treated water are as follows:

Analysis of raw water

Analysis of treated water

$$\text{Ca}^{2+} = 300 \text{ ppm}$$

$$\text{OH}^- = 65 \text{ ppm}$$

$$\text{Mg}^{2+} = 150 \text{ ppm}$$

$$\text{CO}_3^{2-} = 40 \text{ ppm}$$

$$\text{HCO}_3^- = 244 \text{ ppm}$$

$$\text{CO}_2 = 60 \text{ ppm}$$

Calculate:

- i) The amount of lime (80% pure) and soda (90% pure) required to soften one million litres of water using NaAlO_2 as a coagulant @ 41 mg/lit. **12**
- ii) If 10,000 litres of same water sample is soften through a zeolite softener, how much NaCl will be required for its regeneration. **4**

OR

2. a) What are disadvantages of Hard Water use in steam generation in boiler. **5**
 b) Describe Ion – Exchange method of water softening and its advantages and limitations. **6**
 c) Explain electro – dialysis method of desalination. **5**
3. a) What are cause & consequences of corrosion? **4**
 b) Explain the mechanism of electro chemical corrosion. **4**
 c) Explain: **8**
 - i) Water line corrosion
 - ii) Pitting corrosion
 - iii) Phosphoric acid fuel cell
 - iv) Applications, advantages & limitations of fuel cell.

OR

4. a) Explain Pilling Bedworth rule of corrosion. **4**
 b) Explain the mechanism of differential aeration theory of corrosion. **4**
 c) Explain: **8**
 - i) Intergranular Corrosion
 - ii) Cathodic Protection
 - iii) Ni-Cd Battery

5. a) Define HCV & LCV and describe the Bomb Calorimeter method of CV determination. 8
- b) Give the significance of ultimate analysis of coal. 2
- c) Explain Bubble Tower fractional distillation of crude petroleum oil and different composition. 6

OR

6. a) Write note on **any three**. 12
- i) Knocking in IC engine.
- ii) Cetane and Octane number
- iii) Biodiesel
- iv) LPG
- b) Ultimate analysis gave following results C = 72%, H = 8%, O = 8%, S = 1.6%, N = 2.8% and rest is ash. Calculate GCV and NCV using Dulong's formula. 4

7. A producer gas has the following composition by volume:

CO = 30%

H₂ = 12%

CO₂ = 4%

CH₄ = 2%

N₂ = 52%

If 100m³ of their gaseous fuel is to be burnt using 50% excess air.

Calculate:

- i) Minimum volume of air required in m³ at NTP per m³ of fuel. 6
- ii) Quantity of air supplied (by mass) to burn 100m³ of this gaseous fuel. 3
- iii) Percentage composition of dry products of combustion by volume with respect to the actual air supplied. 7

OR

8. a) 2 gm of Benzamide on alkaline hydrolysis forms 1.75 gm benzoic acid product. 3
- b) What is green chemistry? Give its goals. 3
- c) Give traditional and green paths of preparation of Adipic acid. 5
- d) Explain any six principles of green chemistry. 5

9. a) Explain in detail: 9
- i) Thermoplastics & Thermosetting plastic.
 - ii) Free radical mechanism.
 - iii) Techniques of polymerization
- b) Give preparation, properties and applications of LDPE & HDPE. 7

OR

10. Explain in detail **any four**. 16
- i) Epoxy resin
 - ii) SBR
 - iii) Vulcanization of rubber
 - iv) Biodegradable polymers
 - v) Liquid crystalline polymers
 - vi) Fibre reinforced plastic
