

CO Number	Course Outcome(s)
CO1	To define (Remember L-1) and to cite (Remember L-1) general definitions, terms and laws in engineering chemistry.
CO2	To describe (Understand L-2) principle and working of different apparatuses and chemical processes used in engineering.
CO3	To apply (Apply L-3) different chemical formulae in order to calculate (Apply L-3) the amount or volume of materials required in various chemical processes and to solve (Apply L-3) related numerical problems competently by identifying the essential part of a problem and formulating a strategy for solving the problem.
CO4	To analyze (Analysis L-4) different chemistry topics and their relevancy in the engineering field and to differentiate (Analysis L-4) the relative terms used in chemistry.

Time: 3 Hrs.

M. M. 70

Section-A**Q1. Attempt all questions:**

(2X7 = 14 Marks)

- a) Explain the rate of corrosion is higher in non-noble metals while as lower in noble metals? CO2
- b) Show that He_2 molecule does not exist while as H_2 exist on the basis of MOT. CO1
- c) Illustrate Normal Hydrogen Electrode (NHE). CO4
- d) Calculate number of calories and centigrade thermal units in 25 British thermal units. CO3
- e) Calculate the temporary and permanent hardness of water having following dissolved salts: $\text{Ca}(\text{HCO}_3)_2 = 205 \text{ mg/L}$; $\text{Mg}(\text{HCO}_3)_2 = 211 \text{ mg/L}$; $\text{CaSO}_4 = 422 \text{ mg/L}$, $\text{Mg}(\text{NO}_3)_2 = 85 \text{ mg/L}$. CO3
- f) Discuss the polymerization reaction of Plexi glass and BUNA-S. CO2
- g) Describe caustic embrittlement due to hard water. CO1

Section-B**Q2. Attempt all questions:**

(7X3 = 21 Marks)

- a) Illustrate Linear Combination of Atomic Orbital Rule (LCAO) process and explain the energy diagram of N_2 and O_2 CO4
- b) Describe the structure, properties and applications of Fullerene, why it is considered as nano material? CO2

OR

- ii) Describe kjeldahlized nitrogen present in fuel sample, 1.56 gm of sample of coal was kjeldahlized and NH_3 gas thus evolved was absorbed in 50 mL of 0.1 N H_2SO_4 . After absorption, the excess acid was required 10 mL of 0.2 N NaOH for exact neutralization. 2.60 g of the coal sample in a quantitative analysis gave 0.157gm of BaSO_4 , Calculate the percentage of Nitrogen(N) and Sulphur (S) present in fuel sample. CO2
- c i) Interpret classification of polymers, explain various types of polymerization on the basis of following; i) Thermal response ii) Polymeric structure iii) Polymerization. CO3

OR

- ii) Interpret lime soda process for water softening. Calculate the amount of lime (92% pure) and Soda (98% pure) required for the softening of 35000L of water with following analysis: $\text{Ca}(\text{HCO}_3)_2 = 50.5 \text{ mg/L}$, $\text{Mg}(\text{HCO}_3)_2 = 52.4 \text{ mg/L}$, $\text{CaSO}_4 = 48.2 \text{ mg/L}$, $\text{MgSO}_4 = 54.8 \text{ mg/L}$, $\text{MgCl}_2 = 50 \text{ mg/L}$, $\text{NaCl} = 108 \text{ mg/L}$, $\text{KCl} = 50.9 \text{ mg/L}$. CO3

Section- C

Q3. Attempt any one part of the following questions:

(7X1 = 7 Marks)

- a) Interpret various types of electronic transition involved in UV-Visible spectroscopy, explain absorption and intensity shift in UV spectroscopy.

CO3

OR

- b) Interpret various types of alkalinity present in water sample in CaCO_3 equivalent, if a sample contain both type of alkalinity (phenolphthalein and methyl orange), 100 mL of this water sample required 20 mL of N/50 H_2SO_4 for phenolphthalein indicator end point and another 15 mL for the same acid in the presence of methyl orange indicator. Calculate various types of alkalinity present in water sample.

CO3

Q4. Attempt any one part of the following questions:

(7X1 = 7 Marks)

- a) Discuss the construction and working principle of Bomb Calorimeter for the estimation higher/lower calorific value of a solid fuel. The following data were obtained in Bomb calorimeter experiment: Weight of Crucible = 2.65 g, weight of crucible + fuel = 4.90 g, water equivalent of calorimeter 877g, water taken in calorimeter = 2205 g, observed rise in temperature = 1.62°C, cooling correction= 0.030°C, acid correction = 35.25 calorie, fuse wire correction = 1.50 cal., cotton thread correction = 0.60 cal. Calculate the gross calorific value of the sample. If the fuel contains 8% hydrogen, determine the net calorific value also. Assume latent heat of condensation of steam = 587 cal/g.

CO2

OR

- b) Discuss working principle, charging and discharging reactions of lead acid storage battery and explain its important applications.

CO2

Q5. Attempt any one part of the following questions:

(7X1 = 7 Marks)

- a) Illustrate shielding and de-shielding effect in NMR spectroscopy and also draw the NMR spectra of $\text{CH}_3\text{CH}_2\text{OH}$ with number of signals and peaks.

CO4

OR

- b) Illustrate the proximate analysis of coal. Calculate the volume and weight of air required for the complete combustion of 1M³ of gaseous fuel having following composition by volume; H₂= 15 %; CH₄= 40%; C₂H₆ = 10%, C₄H₁₀ = 10%, CO = 20%; O₂= 5% and rest are nitrogen and ash.

CO4

Q6. Attempt any one part of the following questions:

(7X1 = 7 Marks)

- a) Interpret working principle of galvanic cell. Calculate the EMF of the following cell at 25°C, and also write the half and total cell reactions for the following given cell. $\text{Ni(s)} \mid \text{Ni}^{2+} (0.4\text{M}) \parallel \text{Cu}^{2+} (0.0004\text{M}) \mid \text{Cu(s)}$, Given E° of $\text{Ni}^{2+}/\text{Ni} = -0.25$ V and $\text{Cu}^{2+}/\text{Cu} = +0.34$ V.

CO3

OR

- b) Interpret synthesis of *p* and *n* types of conducting polymer, give their important applications in terms of providing conductivity.

CO3

Q7. Attempt any one part of the following questions:

(7X1 = 7 Marks)

- a) Describe the composition of Portland Cement. Explain manufacturing, setting and hardening of cement with suitable chemical reactions.

CO2

OR

- b) Describe the liquid crystalline state of matter with suitable examples, classify them and give their important applications.

CO2