

I B. Tech II Semester Supplementary Examinations Feb. - 2015

ENGINEERING CHEMISTRY

(Common to ECE, EEE, EIE, Bio-Tech, E Com.E, Agri. E)

Time: 3 hours

Max. Marks: 70

Question Paper Consists of **Part-A** and **Part-B**
 Answering the question in **Part-A** is Compulsory,
 Three Questions should be answered from **Part-B**

PART-A

- 1.(i) Describe the principle involved in estimation of hardness of water.
- (ii) Discuss the properties of fullerenes.
- (iii) Calculate the EMF of a Daniel cell at 25°C, when the concentration of ZnSO₄ and CuSO₄ are 0.01 and 0.1M respectively. The standard potential of the cell is 1.2 volts.
- (iv) Define HCV and LCV. How are they calculated?
- (v) Discuss the mechanism of anionic addition polymerization of polymers.

[4+4+6+4+4]

PART-B

- 2.(a) Explain lime soda method of softening hard water. How hot process is advantageous compared to cold process?
- (b) Write notes on (i) Cathodic protection (ii) Electroplating
- (c) Write the engineering applications of liquid crystals. [6+6+4]
- 3.(a) Write notes on ion-selective electrodes.
- (b) A sample of hard water contains the following dissolved substances per litre: Ca(HCO₃)₂ – 18.2 mg, Mg(HCO₃)₂ – 15.6 mg, CaCl₂ – 10.1 mg, MgSO₄ – 12 mg and CaSO₄ – 17.6 mg. Calculate temporary and permanent hardness of water in ppm and in °Cl.
- (c) Describe any one catalytic cracking method to obtain petrol from heavy oil. [6+6+4]
- 4.(a) Write notes on (i) cladding (ii) electrolessplating
- (b) Discuss any two methods of green synthesis.
- (c) How is polyvinyl chloride prepared? Give any two uses and applications of it. [6+6+4]
- 5.(a) Explain any two moulding techniques of plastics.
- (b) Explain conductometric titration of a strong acid Vs weak base with suitable example
- (c) Write notes on desalination of saline water by electrodialysis. [6+6+4]
- 6.(a) Explain proximate analysis of coal and its significance.
- (b) Write briefly about the physical and mechanical properties of polymeric materials.
- (c) Discuss Pilling Bedworth rule. [6+6+4]
- 7.(a) Write notes on (i) Biodegradable polymers (ii) Photovoltaic cells
- (b) Calculate the weight and volume of air required for combustion of 2 kilograms of carbon?
- (c) Explain working principle of CH₃OH-O₂ fuel cell. [6+6+4]

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PART-A

- 1.(i) A coal has the composition by weight: C= 90%, O = 3%, S= 0.5%, N=0.5% and remaining hydrogen and ash. Net calorific value of the coal found to be 8490.5 K.cal/Kg. Calculate the percentage of hydrogen and higher calorific value of coal.
- (ii) Calculate the amount of lime (88.3% pure) and soda (99% pure) required for softening 24,000 liters of water sample, which contains $\text{CaCO}_3=1.85\text{ppm}$; $\text{CaSO}_4=0.34\text{ppm}$; $\text{MgCO}_3=0.42\text{ppm}$; $\text{MgCl}_2=0.76\text{ppm}$, $\text{MgSO}_4=0.9\text{ppm}$; $\text{NaCl}=2.34\text{ppm}$.
- (iii) Write notes on (i) Bio-degradable polymers (ii) Concentration cell (iii) Electroplating
[6+6+(3+4+3)]

PART-B

- 2.(a) What is hardness of water and explain types of hardness with suitable examples.
 (b) Explain preparation of CNTs by chemical vapour deposition method.
 (c) Explain different constituents of paints and their functions.
[5+5+6]
- 3.(a) Explain the working principle of glass electrode.
 (b) Explain the process of break-point chlorination and sterilization of water.
 (c) A producer gas has following composition by volume: $\text{CH}_4=5\%$; $\text{CO}=30\%$; $\text{H}_2=20\%$; $\text{CO}_2=5\%$; $\text{N}_2=40\%$. Calculate the theoretical quantity of air required per cubic meter of the gas.
[5+6+5]
- 4.(a) Explain the mechanism of dry corrosion.
 (b) Explain setting and hardening of cement.
 (c) Write the differences between addition and condensation polymerization.
[5+6+5]
- 5.(a) What are the drawbacks of natural rubbers and explain how to improve the properties of rubber.
 (b) Describe construction and working of lead storage battery.
 (c) Explain the softening of water by permutit process.
[6+5+5]
- 6.(a) What is cracking? Explain moving bed catalytic cracking of heavy oil.
 (b) Explain compounding of plastics.
 (c) Write notes on differential aeration and pitting corrosion.
[6+5+5]
- 7.(a) What is conductometric titration? Explain with suitable example.
 (b) How carbon, sulphur and nitrogen present in coal are estimated?
 (c) Write notes on conducting polymers.
[6+5+5]

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PART-A

- 1.(i) Calculate the amount of lime and soda needed for softening of 30,000 litres of water containing the following salts: $\text{CaCO}_3=10.0$ mg/L; $\text{MgCO}_3=8.4$ mg/L; $\text{CaCl}_2=11.1$ mg/L; $\text{MgSO}_4=6.0$ mg/L; $\text{SiO}_2=1.2$ mg/L, assuming the purity of lime as 90% and soda 95%.
- (ii) A coal has the composition by weight: C= 80%, O= 2%, S= 1.5%, N=1.5% and remaining hydrogen and ash. Net calorific value of the coal found to be 8490.5 K. cal/Kg. Calculate the percentage of hydrogen and high calorific value of coal.
- (iii) Write notes on (i) conducting polymers (ii) galvanic cell (iii) vulcanization

[5+6+(4+4+3)]

PART-B

- 2.(a) Describe the softening of water by permuttit process.
 - (b) Explain mechanism of electro chemical corrosion.
 - (c) Explain effect of CO_2 and SO_2 on cement concrete.
- [5+6+5]
- 3.(a) Describe construction and working of $\text{H}_2\text{-O}_2$ fuel cell.
 - (b) Explain the process of separating salts from the saline water.
 - (c) Write notes on fractional distillation of crude oil with the help of a neat sketch.
- [5+6+5]
- 4.(a) Explain factors affecting the rate of corrosion.
 - (b) Write notes on fiber reinforced plastics with example.
 - (c) Write the differences between thermo plastic and thermosetting plastics.
- [6+5+5]
- 5.(a) Explain preparation and applications of Bakelite and polyethylene.
 - (b) What is potentiometric titration? Explain with suitable example.
 - (c) Explain the formation of scale and sludge in boilers and suggest the removal process
- [6+5+5]
- 6.(a) A coal sample gave the following analysis: C=54%; H=6.5%; O=3%; N=1.8%; moisture=17.3% and remaining is ash. This coal on combustion with excess of air, gave 21.5 of dry flue gases per kg of coal burnt. Calculate the percentage of excess air used for combustion.
 - (b) Explain preparation and applications of buna-s and thiokol rubbers
 - (c) What is hot dipping? Write the differences between galvanizing and tinning.
- [6+5+5]
- 7.(a) Write the importance of electrochemical series. Can we use a copper vessel to store 1 M AgNO_3 solution, given that $E_o \text{Cu}^{2+}/\text{Cu} = +0.34$ V, $E_o \text{Ag}^+/\text{Ag} = +0.80$ V.
 - (b) Write notes on (i) refining (ii) CNG
 - (c) Write applications of CNTs and fullerenes.
- [6+5+5]

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PART-A

- 1.(i) Explain cationic addition polymerization mechanism of polymers.
 - (ii) The percentage composition of a sample of anthracite coal is C = 92; H = 3.5; O = 2; N = 1; S = 0.5 and remainder is ash. Estimate the minimum weight of air required for combustion of 1 Kg of this fuel and the composition of the dry products of combustion by volume if 50% excess air is supplied. Also calculate gross and net calorific value of above fuel. Assume latent heat of condensation of steam.
 - (ii) Discuss (a) stereoregular polymers (b) types of thermotropic liquid crystals
 (c) Ni-Cd cells (d) caustic embrittlement
- [4+6+(3+3+3+3)]

PART -B

- 2.(a) Explain the reactions involved when lime soda method is employed to soften water containing $Mg(HCO_3)_2$, $MgSO_4$, and HCl.
- (b) What are galvanization and tinning process? Compare their advantages as well as limitations.
- (c) What are green house gases and how do they contribute to the green house effect?
 [6+6+4]
- 3.(a) Explain with a suitable example concentration cell.
- (b) What are the advantages and limitations of softening water by ion-exchange process compared to other methods?
- (c) Write notes on fractional distillation of crude oil.
 [6+6+4]
- 4.(a) Write notes on (i) cladding (ii) electroless plating
- (b) Discuss (i) supercritical fluid extraction (ii) Types of carbon nanotubes
- (c) With neat sketch, explain extrusion moulding technique involved in fabrication of plastics.
 [6+6+4]
- 5.(a) Discuss compounding of plastics.
- (b) State Kohlrausch's Law. Give its applications.
- (c) A sample of hard water gives the following results on analysis: $Ca(HCO_3)_2$ – 19.2 ppm, $Mg(HCO_3)_2$ – 14.6 ppm, $CaCl_2$ - 11.1 ppm, $MgCl_2$ – 8.5 ppm, $CaSO_4$ – 13.6 ppm, $MgSO_4$ – 12 ppm and CO_2 – 6.6 ppm. Calculate the lime and soda required for softening 10,000 litres of this water.
 [6+6+4]
- 6.(a) Discuss Orsat process for analysis of flue gases.
- (b) Explain preparation and applications of polyvinyl chloride and polyethylene.
- (c) Discuss factors effecting rate of corrosion by environment.
 [6+6+4]
- 7.(a) Explain any two methods for synthesis of carbon nanotubes.
- (b) Write notes on antiknocking agents and cetane number.
- (c) Explain working principle of dry cell.
 [6+6+4]