

I B. Tech II Semester Regular Examinations August - 2014
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. (a) A coal has the composition by weight: C= 90%, O= 3%, S= 0.5%, N=0.5% and ash 6%. 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.
- (b) A water sample contains $\text{Ca}(\text{HCO}_3)_2 = 32.4 \text{ mg/L}$, $\text{Mg}(\text{HCO}_3)_2 = 29.2 \text{ mg/L}$, $\text{MgCl}_2 = 50 \text{ mg/L}$ and $\text{CaSO}_4 = 13.5 \text{ mg/L}$. Calculate the temporary and total hardness.
- (c) Write short notes on
 - (i) photovoltaic cell
 - (ii) differential aeration corrosion
 - (iii) thermoplastics & thermosetting
 - (iv) importance of electrochemical series

[6+4+12]

PART -B

2. (a) Explain the formation of scales and sludges, how are they not desirable in boilers. Discuss the ways to control these troubles.
 - (b) Discuss the working principle of hydrogen-oxygen fuel cell with neat sketch.
 - (c) Explain electrochemical theory of corrosion.
- [6+5+5]
3. (a) Explain compounding of plastics.
 - (b) Explain the essential requirements for potable water.
 - (c) What are the different solutions that are used to absorb different constituents of flue gases.
- [6+5+5]
4. (a) Write note on working principle of concentration cell.
Given that $E_o(\text{Ni}^{2+}, \text{Ni}) = -0.25 \text{ volt}$; $E_o(\text{Cu}^{2+}, \text{Cu}) = +0.34 \text{ volt}$. What happens if a solution of 1M CuSO_4 be stored in a vessel made of nickel metal?
 - (b) Explain softening of water by ion-exchange process.
 - (c) What are biodegradable polymers? How they are useful?
- [6+5+5]
5. (a) Give in details various factors (metal and environment) influencing the rate of corrosion.
 - (b) What is natural rubber? How it is processed?
 - (c) Describe the construction and working principle of glass electrode.

[6+5+5]

6. (a) What is cracking? Explain moving bed catalytic cracking to produce gasoline.
(b) Describe the synthesis of carbon nanotubes by arc discharge method.
(c) Write notes on importance of organic surface coatings. [6+5+5]
7. (a) Explain setting and hardening of cement with necessary chemical equations.
(b) Explain any one method for synthesis of gasoline.
(c) Write notes on preparation and applications of Thiokol and polyethylene. [6+5+5]

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Subject Code: R13204/R13

Set No - 2

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PART-A

1. (a) Calculate the quantity of lime and soda required to soften 20,000 liters of water containing the salts: $\text{CaCO}_3 = 20.0 \text{ mg/L}$, $\text{MgCO}_3 = 16.8 \text{ mg/L}$, $\text{CaCl}_2 = 22.2 \text{ mg/L}$, $\text{MgSO}_4 = 12.0 \text{ mg/L}$, $\text{SiO}_2 = 1.2 \text{ mg/L}$; the purity of lime as 90% and soda as 95%.
(b) Differentiate galvanizing and tinning.
(c) Write notes on
(i) Calomel electrode
(ii) Buna-S, Buna-N
(iii) Catalytic cracking [6+4+12]

PART -B

2. (a) What are boiler troubles and explain how to minimize these troubles.
(b) Explain the working principle of methanol-oxygen fuel cell.
(c) Define paint. Discuss its constituents and their function. [6+5+5]
3. (a) Explain the mechanism of free radical polymerization with example.
(b) Explain the Fischer-Tropsch process for synthesis of petrol.
(c) Write notes on desalination of saline water using electrodialysis technique. [6+5+5]
4. (a) Explain how the electrode potential of an electrode is determined.
(b) Explain any one method of green synthesis.
(c) Discuss the zeolite process for softening of water. [6+5+5]
5. (a) What is cathodic protection? Explain with examples how cathodic protection can be used to protect iron.
(b) Explain the construction and working principle of nickel-cadmium battery. [6+5+5]
(c) Define tacticity? Explain the significance of stereo specific polymers
6. (a) A sample of dry coal has the following composition: C=84%; $\text{H}_2 = 4\%$; $\text{O}_2 = 6\%$; S=1% and the remainder ash. If 50% excess air is supplied estimate the percentage by volume of the dry products of combustion.
(b) Write notes on conducting polymers.
(c) Using direct chemical attack theory, explain corrosion. [6+5+5]
7. (a) Explain laser ablation method of producing CNTs and applications of CNTs.
(b) Differentiate between thermosetting plastics and thermoplastics. [6+5+5]
(c) How are C, H and S present in a coal is estimated and explain their significance

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PART-A

1. (a) Calculate the quantity of lime and soda required to soften 10,000 liters of water containing the salts: $\text{CaCO}_3 = 10.0 \text{ mg/L}$, $\text{MgCO}_3 = 8.4 \text{ mg/L}$, $\text{CaCl}_2 = 11.1 \text{ mg/L}$, $\text{MgSO}_4 = 6.0 \text{ mg/L}$, $\text{SiO}_2 = 1.2 \text{ mg/L}$, assuming the purity of lime as 90% and soda as 95%.
- (b) Discuss oxygen-hydrogen fuel cell with neat diagram.
- (c) Write short notes on
 - (i) Electroplating
 - (ii) Vulcanization of rubber
 - (iii) Gross and net calorific value
 - (iv) Deterioration of cement concrete

[6+4+12]

PART - B

2. (a) Explain the process of treatment of water for domestic use.
- (b) Write notes on construction and working of calomel electrode.
- (c) Discuss the differential aeration and pitting corrosion. [6+5+5]
3. (a) Discuss the physical and mechanical properties of polymers.
- (b) Explain how cationic and anionic resins soften the hard water.
- (c) Calculate the weight and volume of air required for the combustion of 2 Kg of carbon. Give the composition of the combustion products. [6+5+5]
4. (a) Explain the process of conductometric titrations with two examples.
- (b) Explain the hot lime soda process for softening of hard water. [6+5+5]
- (c) Write short notes on types of thermal liquid crystals.
5. (a) Write notes on passivity of metal and factors affecting rate of corrosion.
- (b) Calculate the EMF of a Daniel cell at 25°C , when the concentration of ZnSO_4 and CuSO_4 are 0.01 and 0.1M respectively. The standard potential of the cell is 1.1 volts.
- (c) Explain the preparation and applications of Bakelite. [6+5+5]
6. (a) Explain the determination of calorific value of a solid fuel using Bomb calorimeter. Suggest the calculations.
- (b) Explain the role of design and selection of materials in prevention of metal corrosion.
- (c) Discuss the applications of green chemistry. [6+5+5]
7. (a) Discuss the chemical vapor deposition method of producing carbon nanotubes and applications of CNTs.
- (b) Write the structure of Gutta-percha and engineering applications of elastomers.
- (c) Define petrol knocking. What is octane rating and how can it be improved. [6+5+5]

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Question Paper Consists of **Part-A** and **Part-B**
Answering the question in **Part-A** is Compulsory,
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PART-A

1. (a) A water sample contains $\text{Mg}(\text{HCO}_3)_2 = 29.2 \text{ mg/L}$, $\text{Ca}(\text{HCO}_3)_2 = 32.4 \text{ mg/L}$,
 $\text{MgCl}_2 = 30 \text{ mg/L}$ and $\text{CaSO}_4 = 13.5 \text{ mg/L}$. Calculate the permanent and total hardness.
- (b) Explain the proximate analysis of coal and its applications.
- (c) Write notes on
 - (i) pitting corrosion
 - (ii) Fullerenes
 - (iii) Concentration cell
 - (iv) Free radical polymerization

[4+6+12]

PART -B

2. (a) Write notes on (i) priming and foaming (ii) caustic embrittlement
 - (b) Define specific, equivalent and molar conductance and mention the units.
 - (c) Write notes on cathodic protection.
- [6+5+5]
3. (a) Define mastication? Discuss the compounding of natural rubber.
 - (b) What is chlorination? Explain the process of break-point chlorination.
 - (c) Explain with a neat sketch fixed bed catalytic cracking to produce gasoline.
- [6+5+5]
4. (a) Explain the construction, working principle and applications of lead storage battery.
 - (b) Write note on fibre reinforced plastics.
 - (c) Write brief notes on determination of hardness of water by EDTA method.
- [6+5+5]
5. (a) Explain how hot dipping and electroplating techniques can be used to protect metals.
 - (b) Derive Nernst equation for single electrode potential.
 - (c) Write the preparation and applications of PVC and Thiokol.
- [6+5+5]
6. (a) The percentage composition of a sample of coal was found as: C = 75.4%; H=5.3%;
O =12.6%; N =3.2%; S =1.3% and remaining is ash. Calculate the minimum weight of air
necessary for complete combustion of 1 kg of coal and percentage composition of dry
products of combustion by weight.
 - (b) Explain how to control corrosion by proper design and selection of metals
 - (c) Write notes on any one method of green synthesis.
- [6+5+5]
7. (a) Give detailed account of setting and hardening of cement
 - (b) Explain the formation of Bakelite? What are its important uses?
 - (c) Write note on fractional distillation of crude oil.
- [6+5+5]
