ECHE 101

B.TECH. (II[nd] SEMESTER) EXAMINATION, 2025-26

BACHELOR OF TECHNOLOGY

(ME, CSE & CSE-AIML)

ENGINEERING CHEMISTRY

2403

Time : Three Hours] [Maximum Marks : 75

Note: There are **three** sections (**A**, **B** and **C**) and candidate has to attempt questions from all sections. Marks are indicated against each section.

Section-A

1. Answer **all** questions : 5×3=15

   (a) Distinguish between temporary and permanent hardness.

   (b) Define 'Blue Shift' and 'Red Shift' in UV spectroscopy.

   (c) Distinguish between Natural and synthetic polymers with suitable examples.

   (d) What is 'Phase Rule' ?

   (e) Define fuel and mention the characteristic of a good fuel.

Section-B

Note: Answer **all** questions of the following : 4×5=20

2. (a) Describe a galvanic cell with suitable diagram and Electrode reactions.

Or

(b) Explain briefly the Zeolite process for water softening.

3. (a) In a polymer sample 30% molecule have molecular mass 40,000, 40% have molecular mass 30,000 and rest 30% have 60,000. Calculate the number average and weight average molecular mass.

Or

(b) Discuss the structure and properties of Graphite.

4. (a) Draw the MO diagram of oxygen molecule. Arrange the following molecular species in their increasing order of stability (giving bond orders) : O_2, O_2^+, O_2^-, O_2^{2-}

Or

(b) Discuss the preparation, properties and uses of 'SBR' and 'NBR'.

5. (a) Discuss the band structure of Insulators, conductors and semiconductors. Explain 'p-type' semiconductor with suitable diagram and example.

Or

(b) Discuss the preparation, properties and uses of 'Neoprene' and 'Terylene'.

Section-C

Note: Answer any **two** questions of the following : 2×20=40

6. Define the terms phase, component and degree of freedom. With a neat spetch describe the phase diagram of water system and explain all the curves, equilibrium and point in the diagram.

7. What are nanomaterials ? Classify them on the basis of dimensions. Explain different approaches of synthesis and also mention their properties and application in various fields.

8. Write down the cell reaction. If Zn and Ag electrode are clipped in respected solution of their ions. Find out the E.M.F of the cell given that –

$$E^0_{Zn^{2+}/Zn} = -0.76v$$

$$E^0_{Ag^+/Ag} = 0.8v$$

Concentration of Zn^{2+} and Ag^+ ions are 0.2M and 0.01M respectively.

9. Write short note on 'conducting polymers' and 'Biodegradable polymers'.

5900

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Note: There are **three** sections (**A**, **B** and **C**) and candidate has to attempt questions from all sections. Marks are indicated against each section.

Section-A

1. Attempt **all** parts of the following : 5×3=15

   (a) Define fuel and mention the characteristics of a good fuel.

   (b) Define 'Polymer' and write the difference between homopolymer and copolymer with suitable examples.

   (c) Explain why O_2 molecule is paramagnetic and N_2 molecule is diamagnetic with molecular orbital diagram.

   (d) Define Schottky and frenkel defect in a crystal with suitable examples.

(e) Write the application of IR Spectroscopy. Explain 'fingerprint region' and 'functional group region in IR Spectroscopy.

Section-B

Note: Attempt **all** questions : 4×5=20

2. (a) Write and discuss preparation, properties and uses of styrene Butadiene rubber and nitrile rubber.

Or

(b) What is hardness of water ? Explain the advantages and disadvantages of the Zeolite and lime-soda processes for water softening.

3. (a) Define 'Semiconductors' and explain 'n-type' and 'p-type' Semiconductors with suitable diagram and examples.

Or

(b) Explain the setting and hardening of cement with suitable chemical reactions and also mention the role of gypsum in hydration of cement.

4. (a) Define liquid Crystal. Classify liquid crystal on the basis of molecular arrangement and mention important application of liquid crystals.

Or

(b) What is 'LCV' and 'HCV' ? Calculate the HCV of the fuel in Kcal/Kg if 0.72g of fuel containing 80% carbon, when burnt in a bomb calorimeter, increased the temperature of water from 27.3°C to 29.1°C and the calorimeter contains 250g of water and its water equivalent is 150g.

5. (a) Describe construction of a galvanic cell. Write down the electrode reactions and formula for its E.M.F.

Or

(b) Describe the structure of graphite. Why is graphite a good conductor of electricity? Why it is used as a lubricant?

Section-C

Note: Attempt any **two** questions : 2×20=40

6. What are Organometallics ? Mention their classification and describe the synthesis of σ-bonded organometallic compounds & metal carbonyls. Also mention the application of organometallic compounds in polymerization.

7. State phase rule. Define the terms phase, component and degree of freedom. Calculate the maximum number of phases for one component system. Draw a phase diagram for water system. Label it and discuss the importance of various points, lines and areas at equilibrium.

8. Define Spectroscopy. What is Born Oppenheimer approximation? Describe the principle of UV-visible Spectroscopy. Explain the electronic transitions in UV-visible Spectroscopy. Also mention the application of UV-visible spectroscopy.

9. Define corrosion of metals. What are the factors affecting corrosion ? Explain the electrochemical theory of wet corrosion with mechanism. Also mention how can corrosion be controlled by various methods.

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