VISVESVARAYA TECHNOLOGICAL UNIVERSITY

I/II Semester B.E.

06CHE 12 / 06CHE22 ENGINEERING CHEMISTRY

MODEL QUESTION PAPER-I

Duration: 03 hours   **Max. Marks: 100**

Instructions:

i)   **Answer any five questions choosing at least two questions from each part.**

ii) **Answers must be specific and precise.**

iii) **Draw neat diagrams and write equations wherever necessary.**

Question No.	Question	Marks
	PART –A	

1. a) How is calorific value of a solid fuel determined using bomb calorimeter?   **5**

   b) What is cracking of petroleum? Explain fluidized catalytic cracking.   **5**

   c) What is a photovoltaic cell? Explain the working of a photovoltaic cell.   **6**

   d) Calculate the Gross calorific value of a sample of coke from the following data:
   Mass of coke = 0.8 kg;   Water equivalent of calorimeter = 2.5 kg;
   Mass of water: 1.3 kg;   Specific heat of water = 4.187 $KJkg^{-1}K^{-1}$;
   Rise in temperature = 1.8K   **4**

2. a) What is single electrode potential? Explain the origin of single electrode potential.   **6**

   b) What are ion-selective electrodes? Explain the measurement of pH of a solution using a glass electrode.   **8**

   c) Calculate the standard electrode potential of Cu^{2+}/Cu if its electrode potential at $25^{0}C$ is 0.312V when $[Cu^{2+}]$ is 0.02M.   **6**

3. a) Explain the following battery characteristics:
   (i) Voltage (ii) Capacity   (iii) Energy density (iv) Cycle life   **8**

   b) Describe the construction of a Ni-MH battery. Give the relevant reactions that occur during discharging and charging. Mention its applications.   **6**

   c) Discuss the construction and working of H_2-O_2 fuel cell. Why is the water formed in the H_2-O_2 fuel cell removed continuously? Mention its applications.   **6**

4. a) What is metallic corrosion? Discuss the corrosion of iron based on electrochemical theory   8

   b) Explain: (i) ship sailing in water corrodes below water line (ii) copper bolt should not be used in contact with steel.   6

   c) What is anodizing? Explain anodizing of aluminium.   6

PART – B

5. a) Explain the effect of the following factors on the nature of electro deposit. (i) Current density (ii) pH (iii) Throwing power & (iv) Temperature   8

   b) Discuss the electrolesss plating technique of copper in the manufacture of printed circuit boards.   7

   c) Give an account of chromium plating.   5

6. a) Distinguish between thermotropic and lyotropic liquid crystals with examples   6

   b) Explain the liquid crystalline behaviour in PAA series.   6

   c) State Beer-Lambert's law. Explain the principle and instrumentation of colorimetry.   8

7. a) Explain the free radical mechanism of addition polymerization taking ethylene as an example.   6

   b) What is glass transition temperature of a polymer? Discuss the factors affecting the glass transition temperature.   5

   c) What are adhesives? Explain the manufacture of epoxy resin.   4

   d) What are elastomers? Mention the advantages of synthetic rubber over natural rubber.   5

8. a) How is alkalinity in water caused? Explain the method of determination of alkalinity by indicators method.   6

   b) Describe the primary and secondary methods of sewage treatment.   6

   c) 100ml of a water sample required 20ml of N/50 H_2SO_4 for neutralisation to phenolphthalein endpoint. After this methyl orange indicator was added to this and further acid required was again 20ml. Calculate the alkalinity of water as $CaCO_3$ in ppm.   3

   d) Define COD and BOD. Calculate the BOD value of a sewage sample containing 9.2 mg/dm^3 of organic matter with the formula $C_6H_{12}O_6$.   5

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I/II Semester B.E.

06CHE 12 / 06CHE22 ENGINEERING CHEMISTRY

MODEL QUESTION PAPER-II

Duration: 03 hours   **Max. Marks: 100**

Instructions:

   i)   **Answer any five questions choosing at least two questions from each part.**

   ii) **Answers must be specific and precise.**

   iii) **Draw neat diagrams and write equations wherever necessary.**

<u>Part – A</u>

1. (a)   Define gross and net calorific value. Explain Bomb calorimetric method of determining
     calorific value of a solid fuel.
  (b) Calculate Gross calorific value and Net calorific value of a coal sample from the
     following data:
     Mass of coal sample taken = 8.5×10^{-4}Kg;
     Mass of water taken in the calorimeter = 3.5Kg;
     Water equivalent of calorimeter = 0.5Kg;
     Initial temperature of water in calorimeter = 25^0C;
     Final temperature of water in calorimeter   = 27.5^0C;
     Percentage of Hydrogen in the coal sample = 2.5;
     Latent Heat of Steam = 2455KJ/Kg.
     Specific heat of Water = 4.187 KJ/Kg/K
  (c)   What is Photovoltaic cell & explain the working of a PV cell.

                                    8+6+6

2. (a) Define single electrode potential and standard electrode potential. Derive Nernst
     equation for electrode potential.
  (b)   What are ion - selective electrodes? Give the construction of glass electrode and explain
     the experimental method of determining pH using glass electrode.
  (c)   An electro chemical cell consists of iron electrode dipped in 0.1M $FeSO_4$ and silver
     electrode dipped in 0.05M $AgNO_3$.   Write the cell representation, cell reactions and
     calculate e.m.f of the cell at 298K. Given that the standard reduction potentials of iron
     and silver electrodes are -0.44V and +0.80V respectively.

                                    8+8+4

3. (a) Discuss the following battery characteristics:
   (i) Voltage (ii) Capacity (iii) Power Density   (iv) Energy Efficiency.
   (b) Describe the construction and working of Li – MnO_2 battery. Mention its applications.
   (c) Give the advantages of fuel cells. Describe the construction and working of H_2-O_2 fuel cell.

   8+6+6

4. (a) What is corrosion? Explain the electro chemical theory of corrosion taking Iron as an example.
   (b) Discuss how the corrosion is controlled by (i) anodizing and (ii) tinning.
   (c) Write a note on corrosion inhibitors.

   8+8+4

Part – B

5. (a) Explain the following terms (i) Polarization (ii) decomposition potential and (iii) over-voltage.
   (b) Give any three objectives of electroplating and explain the electroplating of chromium. Why chromium anode is not used in electroplating of chromium?
   (c) Distinguish between electroplating and electroless plating.

   6+8+6

6. (a) What are liquid crystals? Explain the molecular ordering in the following liquid crystal phases (i) Nematic phase (ii) Chiral Nematic phase (iii) Smectic phase
   (b) Explain the applications of liquid crystals in display systems.
   (c) Explain theory and application of colorimeter.

   8+6+6

7. (a) What are polymers? Explain the free radical mechanism of addition polymerization taking ethylene as an example.
   (b) Define Tg and mention its significance. Explain any three factors that affect the Tg value of a polymer.
   (c) Explain the manufacture of the following polymers and mention their uses.
   (i) Butyl rubber (ii) Phenol formaldehyde resins.

   8+6+6

8. (a) What is potable water? Describe purification of water by reverse osmosis process.
   (b) Explain how the following constituents are determined. a) chlorides b) fluorides & c) nitrates.
   (c) Define COD. In COD experiment, $30cm^3$ of an effluent sample required $9.9cm^3$ of 0.001M $K_2Cr_2O_7$ for oxidation. Calculate the COD of the sample.

   8+6+6

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