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<b>NEW SCHEME</b>
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**I/II Semester B.E. Degree Examination, Dec.06/Jan. 07**  
**Common to all Branches**  
**Engineering Chemistry**

Time: 3 hrs.]

[Max. Marks:100

**Note: Answer any FIVE full questions, choosing at least TWO questions from each Part A and Part B.**

**PART A**

1. a. Distinguish between gross and net calorific value of a fuel. (04 Marks)  
 b. What is meant by cracking of petroleum? Explain fluidized bed catalytic cracking. (07 Marks)  
 c. On burning 0.96 grams of a solid fuel in Bomb calorimeter, the temperature of 3,500 grams of water increased by 2.7<sup>0</sup>C. Water equivalent of calorimeter and latent heat of steam are 385 grams and 587 cal/gram respectively. If the fuel contains 5% H<sub>2</sub>, calculate its gross and net calorific values. (06 Marks)  
 d. Write a note on power alcohol. (03 Marks)
2. a. Define electrode potential and derive Nernst equation for electrode potential. (05 Marks)  
 b. What are the advantages of secondary reference electrodes? Explain the construction and working of Ag/AgCl electrode. (06 Marks)  
 c. What are electrochemical cells? Distinguish primary cells from secondary cells with examples. (05 Marks)  
 d. What are concentration cells? Calculate cell potential of the following cell at 298 k.  
 $Ag | Ag^+ (0.001M) || Ag^+ (0.50 M) | Ag.$   
 What will be cell potential, when the concentration of silver ions in the above cell is changed from 0.001M to 0.0005 M at same temperature? (04 Marks)
3. a. How does a fuel cell differ from battery? Explain the construction and working of Nickel – metal hydride battery. (08 Marks)  
 b. Explain the construction, working and application of H<sub>2</sub>-O<sub>2</sub> fuel cell, with cell reaction. (06 Marks)  
 c. Give the classification of batteries with examples. (06 Marks)
4. a. Explain stress corrosion with examples. (04 Marks)  
 b. What are corrosion inhibitors? Explain how corrosion is controlled by using anodic and cathodic inhibitors? (07 Marks)  
 c. Write a brief note on the effect of following factors on the rate of corrosion  
 i) Nature of metal ii) Hydrogen – over voltage iii) Relative areas of anode and cathode. (09 Marks)

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**PART B**

- 5 a. What is electroplating? Give the technological importance of metal finishing. (04 Marks)
- b. Explain the following factors influencing the nature of deposit : i) Complexing agents (08 Marks)  
ii) Brighteners iii) Levellers and iv) Wetting agents. (04 Marks)
- c. Discuss the electroless plating of copper on PCB. (04 Marks)
- d. Write a note on over voltage governing the metal finishing. (04 Marks)
- 6 a. Explain the following with examples (06 Marks)  
i) Thermotropic liquid crystal and ii) Lyotropic liquid crystal.
- b. What is homologues series? Explain the liquid crystalline behavior of homologues of MBBA. (06 Marks)
- c. Discuss the instrumentation and applications of conductometric estimation. (08 Marks)
- 7 a. What are adhesives? Explain the synthesis and applications of epoxy resin. (06 Marks)
- b. What are elastomers? Mention the advantages of synthetic elastomers. (04 Marks)
- c. Give the synthesis and applications of butyl rubber. (04 Marks)
- d. Discuss the mechanism of conductance in polyacetylene. (06 Marks)
- 8 a. What is potable water? Discuss the purification of water by reverse osmosis process. (05 Marks)
- b. Explain the method of determining sulphate content in water by gravimetric method. (05 Marks)
- c. Explain the determination of dissolved oxygen by Winkler method. Give the reactions involved. (06 Marks)
- d. Describe the secondary treatment of sewage by activated sludge process. (04 Marks)

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**First / Second Semester B.E. Degree Examination, July 2007**

**Common to All Branches**

**Engineering Chemistry**

PRINIVAS INSTITUTE OF TECHNOLOGY  
BANGALORE

Time: 3 hrs.]

[Max. Marks: 100]

**Note : Answer any FIVE full questions, choosing at least TWO from each part.**

**PART A**

- 1 a. Describe Fischer-Tropsch method of synthesis of petrol. (06 Marks)
- b. Explain the process of doping of silicon. (05 Marks)
- c. What is cracking? Explain fluidized catalytic cracking. (05 Marks)
- d. Discuss the mechanism of knocking. (04 Marks)
- 2 a. Explain the origin of single electrode potential. Derive Nernst equation for electrode potential. (07 Marks)
- b. What are reference electrodes? Mention the limitations of primary reference electrode and advantages of secondary reference electrodes. (04 Marks)
- c. Write a note on calomel electrode. (04 Marks)
- d. Represent the cell formed by the coupling of two copper electrodes immersed in cupric sulphate solutions. Concentration of cupric ions in one electrode system is 100 times more concentrated than the other. Write the cell reaction and calculate the potential at 300 K. (05 Marks)
- 3 a. Define fuel cell. How does it differ from a conventional galvanic cell? (04 Marks)
- b. Explain the following fuel cells:  
i) Molten carbonate ii) Solid polymer electrolyte. (06 Marks)
- c. Explain the following battery characteristics:  
i) Cycle life ii) Shelf life iii) Energy efficiency. (06 Marks)
- d. Describe the construction and working of zinc-air battery. (04 Marks)
- 4 a. Define corrosion. Explain electrochemical theory of corrosion, taking iron as an example. (08 Marks)
- b. Explain differential metal corrosion with suitable example. (06 Marks)
- c. What is cathodic protection? Explain corrosion control by sacrificial anode method. (06 Marks)

**PART B**

- 5 a. What is electroless plating? Mention its advantages. (04 Marks)
- b. Discuss the following factors influencing the nature of deposit:  
i) Throwing power ii) pH of the electrolytic bath and iii) Temperature. (06 Marks)
- c. Discuss the electroplating of gold and mention its applications. (05 Marks)
- d. Explain electroless plating of copper and its applications. (05 Marks)
- 6 a. Distinguish between thermotropic and lyotropic liquid crystals with examples. (06 Marks)
- b. Explain the working of a liquid crystal in display systems. (06 Marks)
- c. What are the advantages of instrumental methods? (03 Marks)
- d. Explain the estimation of amount of strong acid in a given solution conductometrically. (05 Marks)
- 7 a. Define polymerization. Explain solution and suspension polymerization techniques. (05 Marks)
- b. Give the synthesis, properties and uses of: i) Teflon ii) Butyl rubber. (10 Marks)
- c. What are conducting polymers? Give the structure of polyaniline and mention its applications. (05 Marks)
- 8 a. Discuss the types of impurities present in natural water. (04 Marks)
- b. Explain the determination of hardness of water by complexometric method. (06 Marks)
- c. Explain the electrodialysis method of desalination of water. (04 Marks)
- d. Discuss determination of chloride by Argentometric method. (06 Marks)



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**First/Second Semester B.E. Degree Examination, Dec. 07 / Jan. 08**  
**Engineering Chemistry**

Time: 3 hrs.

Max. Marks: 100

(3)

**Note : Answer any FIVE full questions, choosing at least two questions from each part.**

**Part A**

- 1 a. Describe the Bomb calorimetric method of determination of calorific value of a solid fuel. (06 Marks)
- b. What is reforming of petroleum? Give any three reactions involved in reforming. (05 Marks)
- c. What is power alcohol? Give its advantages as a fuel. (04 Marks)
- d. What is a photo voltaic cell? Explain its working. (05 Marks)
- 2 a. What are ion selective electrodes? Explain the measurement of pH of a solution using glass electrode. (07 Marks)
- b. Explain the origin of single electrode potential. (05 Marks)
- c. Describe the construction and working of a calomel electrode. (04 Marks)
- d. Calculate the emf of the cell  $\text{Fe}/\text{Fe}^{2+}(0.01\text{M})\parallel\text{Ag}^+(0.1\text{M})/\text{Ag}$  at 298 K, if standard electrode potential of Fe and Ag electrodes are  $-0.42\text{ V}$  and  $0.8\text{ V}$  respectively. (04 Marks)
- 3 a. Explain the construction and working of lead acid battery along with the reactions involved during charging and discharging. Mention its applications. (08 Marks)
- b. Explain the construction, working and applications of Nickel – metal hydride battery. (06 Marks)
- c. Explain the construction and working of the hydrogen – oxygen fuel cell. (06 Marks)
- 4 a. Explain the differential aeration corrosion with a suitable example. (05 Marks)
- b. How does the following factors affect the rate of corrosion:
  - i) Nature of corrosion product.
  - ii) Temperature.
  - iii) PH.
 (09 Marks)
- c. Write notes on: i) Galvanizing ii) Tinning (06 Marks)

**Part B**

- 5 a. What is electroplating? Explain how the following factors influence the nature of electrodeposit: i) Metal ion concentration. ii) Wetting agents. (05 Marks)
- b. Discuss the electro plating of chromium. (05 Marks)
- c. Mention the technological importance of metal finishing. (05 Marks)
- d. Explain electroless plating of Nickel and its applications. (05 Marks)
- 6 a. Discuss the instrumentation and applications of colorimetric estimation. (08 Marks)
- b. What are liquid crystals? Explain the molecular ordering in the following liquid crystal phases: i) Nematic crystal phase ii) Chiral nematic phase iii) Smectic phase. (08 Marks)
- c. Distinguish between thermotropic and lyotropic liquid crystals with examples. (04 Marks)
- 7 a. What are polymers? Explain the free radical mechanism of addition polymerization, taking ethylene as an example. (06 Marks)
- b. What is glass transition temperature? Mention its significance. Discuss any two factors affecting glass transition temperature. (06 Marks)
- c. Explain the manufacture of the following polymers and mention their uses:
  - i) Phenol-formaldehyde
  - ii) Polymethyl methacrylate.
 (08 Marks)
- 8 a. Discuss the different types of impurities present in natural water with examples. (04 Marks)
- b. Write a note on reverse osmosis. (05 Marks)
- c. Explain the method of determining sulphate content in water by gravimetric method. (06 Marks)
- d. Calculate the COD of the effluent sample, when  $25\text{ cm}^3$  of the effluent requires  $8.3\text{ cm}^3$  of  $0.001\text{ M K}_2\text{Cr}_2\text{O}_7$  for complete oxidation. (05 Marks)

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06CHE12/22

**First/Second Semester B.E. Degree Examination, June/July 08**  
**Engineering Chemistry**

Time: 3 hrs.

Max. Marks: 100

**Note : Answer any FIVE full questions, choosing at least two questions from each part.**

Part - A

- 1 a. Describe the experimental determination of calorific value of a solid fuel using Bomb calorimeter. (06 Marks)
- b. What is synthetic petrol? Describe the Bergius method of synthesis of petrol. (05 Marks)
- c. Write a note on reforming of petrol. (04 Marks)
- d. Explain construction and working of silicon photovoltaic cell. (05 Marks)
- 2 a. What are reference electrodes? Explain the construction and working of calomel electrode. (05 Marks)
- b. Calculate the standard electrode potential of  $\text{Cu}^{2+} | \text{Cu}$  if its electrode potential at  $25^\circ \text{C}$  is 0.296V when  $[\text{Cu}^{2+}]$  is 0.015 M. (03 Marks)
- c. What are ion-selective electrodes? Explain the measurement of pH of a solution using glass electrode. (07 Marks)
- d. Derive Nernst's equation on electrode potential. (05 Marks)
- 3 a. Explain the following battery characteristics:  
i) Energy efficiency ii) Current capacity iii) Cycle life. (06 Marks)
- b. Describe the construction and working of Lead – acid battery. (08 Marks)
- c. Describe the construction and working of  $\text{H}_2 - \text{O}_2$  fuel cell. (06 Marks)
- 4 a. Discuss the effect of following on the rate of corrosion.  
i) Nature of the metal ; ii) Nature of the corrosion product ; iii) pH ; iv) area effect. (08 Marks)
- b. Explain differential aeration corrosion with suitable example. (06 Marks)
- c. What is cathodic protection? How a metal is cathodically protected by sacrificial anode method. (06 Marks)

Part - B

- 5 a. Define polarization, decomposition potential and over voltage. Mention their significance with reference to electrode position. (08 Marks)
- b. How do the following affect the nature of electroplating?  
i) Current density ii) temperature iii) pH iv) Organic additives. (08 Marks)
- c. What is electroless plating? Mention any two advantages. (04 Marks)
- 6 a. What are liquid crystals? Distinguish between thermotropic and lyotropic liquid crystals with examples. (06 Marks)
- b. Explain the working of liquid crystals in display systems. (06 Marks)
- c. What are the advantages of conductometric titrations over conventional titrations? (03 Marks)
- d. Explain the determination of concentration of an unknown solution by colorimetric method. (05 Marks)
- 7 a. Define polymerization. Explain different types of polymerization processes with suitable examples. (05 Marks)
- b. Give synthesis and uses of the following polymers i) Teflon ii) Neoprene (06 Marks)
- c. Write a note on compounding of resins. (04 Marks)
- d. Write preparation, properties and uses of epoxy resins. (05 Marks)
- 8 a. Explain temporary and permanent hardness of water. (04 Marks)
- b. Define B.O.D and C.O.D and mention various steps involved in sewage treatment. (04 Marks)
- c. Describe the argentometric method of estimation of chloride content of a water sample. (04 Marks)
- d. What is potable water? Describe the electrodialysis process of desalination of water. (08 Marks)





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06CHE12/22

**First / Second Semester B.E. Degree Examination, Dec.08/Jan.09**  
**Engineering Chemistry**

Time: 3 hrs.

Max. Marks:100

- Note:1. Answer any FIVE full questions selecting at least two questions from each part.**  
**2. Answer all objective type questions only in first and second writing pages.**  
**3. Answer for Objective type questions shall not be repeated.**

**Part A**

- 1 a. i) Bomb calorimeter is used for determining the calorific value of,  
A) Solid fuel B) Liquid fuel C) Gaseous fuel D) Both solid fuel and liquid fuel  
ii) Octane number is related to the petroleum product  
A) Diesel B) Kerosine C) Petrol D) Lubricating oil  
iii) The process by which the higher hydrocarbons are broken into lower hydrocarbons by the application of heat by,  
A) Combustion B) Cracking C) Sparking D) Jetting  
iv) Quality of diesel fuel is determined by,  
A) Octane rating B) Percentage of carbon  
C) Length of hydrocarbon chain D) Cetane number (04 Marks)
- b. What is meant by cracking? Describe with a neat diagram fluidized bed catalytic cracking. (06 Marks)
- c. What is knocking? What are its ill-effects? Give the mechanism of knocking. (05 Marks)
- d. What are chemical fuels? Give the classification of fuels with examples. (05 Marks)
- 2 a. i) Calomel electrode is reversible with respect to  
A) Mercury ion B) Chloride ion C) Both ions D) None of these  
ii) A metal rod is dipped in a solution of its ions. Its electrode potential is independent of,  
A) Temperature of the solution B) Concentration of the solution  
C) Area of the metal exposed D) Nature of the metal  
iii) A galvanic cell converts  
A) Electrical energy into chemical energy B) Chemical energy into electrical energy  
C) Electrical energy into heat energy D) Chemical energy into heat energy  
iv) The potential of the standard Hydrogen electrode is taken as  
A) 1 volt B) 0 volt C) 10 volt D) None of these (04 Marks)
- b. Define single electrode potential and standard electrode potential and explain the origin of electrode potential. (06 Marks)
- c. Explain the determination of electrode potential copper electrode dipped in 0.5 m CuSO<sub>4</sub> using standard hydrogen electrode. What would be the measured emf? ( $E^\circ_{\text{Cu}/\text{Cu}^{++}} = +0.34 \text{ V}$ ) (06 Marks)
- d. Write the cell reaction and calculate the emf of the following cell at 298 K, given  
 $E^\circ_{\text{cell}} = 0.46 \text{ V}$   
 $\text{Cu}_{(s)} | \text{Cu}^{+2} (0.01 \text{ M}) || \text{Ag}^+ (0.1 \text{ M}) | \text{Ag}_{(s)}$  (04 Marks)

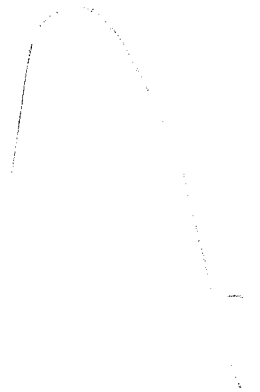
- 3 a. i) In which battery, a key component is separated from the rest of the battery prior to activation  
 A) Primary battery B) Secondary battery C) Reserve battery D) None of these  
 ii) In hydrogen-oxygen fuel cell, which of the following electrolyte is used,  
 A) KOH B)  $\text{NH}_4\text{OH}$  C)  $\text{CH}_3\text{COOH}$  D) None of these  
 iii) The reaction that takes place at anode of a battery,  
 C) Reduction B) Oxidation C) Neutralisation D) Addition  
 iv) Which of the following is a rechargeable battery  
 A) Zn-MnO<sub>2</sub> battery B) Li – MnO<sub>2</sub> battery  
 C) Lead – acid battery D) None of these (04 Marks)
- b. Describe the construction and working of Zn-air battery. (06 Marks)
- c. Describe the construction and working of methanol-oxygen fuel cell. (06 Marks)
- d. Explain the following battery characteristics: i) Voltage ii) Power density (04 Marks)
- 4 a. i) Corrosion process is an example of ,  
 A) Oxidation B) Reduction C) Electrolysis D) Both A and B  
 ii) Caustic embrittlement is a classical example of ,  
 A) Differential aeration corrosion B) Stress corrosion  
 C) Differential metal corrosion D) None of these  
 iii) Galvanising is the process of coating iron with  
 A) Tin B) Zinc C) Copper D) Nickel  
 iv) Water-line corrosion is an example of  
 A) Differential aeration corrosion B) Stress corrosion  
 C) Differential metal corrosion D) None of these (04 Marks)
- b. Define the term corrosion. Explain the rusting of iron based on electrochemical theory of corrosion. (06 Marks)
- c. Discuss the anodic protection as a method of corrosion control. (06 Marks)
- d. Write a note on Galvanisation. (04 Marks)

### Part B

- 5 a. i) Conductors and insulators can be plated by,  
 A) Electroplating B) Electroless plating C) Electropolishing D) None  
 ii) The phenomenon in which the back emf produced due to the products of electrolysis is  
 A) Electroplating B) Electroless plating C) Polarisation D) None of these.  
 iii) When the metal structure to plated is irregular, the process employed is,  
 A) Electroplating B) Electropolishing C) Electrolessplating D) None of these  
 iv) Addition of complexing agent to the plating bath is to,  
 A) Increase the rate of electro deposition B) Increase the metal ion concentration  
 C) Decrease the metal ion concentration D) None of these (04 Marks)
- b. Explain the process of electroless plating of copper. (06 Marks)
- c. Mention the differences between electroplating and electroless plating. (06 Marks)
- d. Explain the following factors that affect the nature of electrodeposit,  
 i) Throwing power ii) Current density iii) Metal ion concentration (04 Marks)
- 6 a. i) An ion selective electrode used in the determination of pH is  
 A) Calomel electrode B) Silver – Silver chloride electrode  
 C) Glass electrode D) None of these  
 ii) The class of compounds that exhibit liquid crystalline behaviour on variation of temperature alone are referred to as,  
 A) Lyotropic liquid crystals B) Thermotropic liquid crystals  
 C) Isotropic liquids D) None of these

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- iii) Instrumental methods of analysis are widely adopted when compared to classical methods of analysis because,  
A) The methods are much faster B) Applicable at concentrations  
C) The analytical process can be automated D) All the above
- iv) Colorimetry involves measurement of absorbance using monochromatic light in the,  
A) UV range B) IR range C) Visible range D) All the above (04 Marks)
- b. What are potentiometric titrations? Discuss the application of potentiometry in the estimation of FAS using standard  $K_2Cr_2O_7$  solution. (06 Marks)
- c. Explain, Nematic phase, Cholesteric phase and Smectic phase. (06 Marks)
- d. Discuss the application of conductometry in the determination of the amount of hydrochloric acid using standard NaOH solution. (04 Marks)
- 7
- a. i) Tetrafluoro ethylene is the monomer of,  
A) Nylon - 66 B) Neoprene C) Teflon D) PVC
- ii) Phenol-formaldehyde resin is commercially,  
A) PVC B) Bakelite C) Elastomer D) Nylon
- iii) Sulphur is used particularly in,  
A) Manufacture of Buna - S B) Compounding of plastics  
C) Corrosion control D) Vulcanisation of raw rubber
- iv) Isoprene is a monomer of,  
A) Natural rubber B) Synthetic rubber C) Starch D) PVC (04 Marks)
- b. Explain the free radical mechanism of addition polymerization, taking ethylene as an example. (06 Marks)
- c. Differentiate between thermoplastics and thermosettings. Give one example each. (04 Marks)
- d. Give the synthesis and uses of, i) Plexiglass ii) Butyl rubber. (06 Marks)
- 8
- a. i) The indicator used for the estimation of total hardness of a given water sample by EDTA method,  
A) Starch B) Eriochrome black - T C) Ferroin D) Methyl orange
- ii) Temporary hardness of water is caused due to the presence of  
A)  $CaCO_3$  B)  $CaCl_2$  C)  $Mg(HCO_3)_2$  D) None of these
- iii) The method used for desalination of water is,  
A) Zeolite process B) Lime-soda process  
C) Ion-Exchange process D) Electrodialysis
- iv) The indicator used in the determination of chloride content of water sample by Mohr's method,  
A) Phenolphthalein B)  $K_2CrO_4$  C) Starch D) Ferroin (04 Marks)
- b. Define COD and explain the method of determining COD. (06 Marks)
- c. What is hard water? Explain the estimation of total hardness of water by EDTA method. (06 Marks)
- d. What is potable water? Give the characteristics of potable water. (04 Marks)

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**First / Second Semester B.E. Degree Examination, June-July 2009  
Engineering Chemistry**

Time: 3 hrs.

Max. Marks:100

- Note :** 1. Answer any Five full question, choosing at least two from each part.  
2. Answer all objectives type questions only in OMR sheet page 5 of the Answer Booklet.  
3. Answer to the objective type questions on sheets other than OMR will not be valued.

**PART - A**

- 1 a. i) The tendency of knocking is high in  
A) Aromatics B) Olefins  
C) Straight chain hydrocarbons D) Cycloparaffins.
- ii) A device in which electricity is produced using solar energy is called  
A) Fuel cell B) Voltaic cell  
C) Photovoltaic cell D) Concentration cell.
- iii) Knocking is due to  
A) Slow Combustion B) Instantaneous explosive combustion  
C) Incomplete combustion D) All
- iv) Which of the following is a primary fuel  
A) Producer gas B) Coal gas  
C) Petroleum D) Water gas. (04 Marks)
- b. What is cracking? Explain fluidised bed catalytic cracking. (06 Marks)
- c. Give the construction and working of photovoltaic cell. (05 Marks)
- d. Calculate the gross and net calorific value of a sample of coke from the following data.  
Mass of coke =  $0.795 \times 10^{-3}$  kg  
Water equivalent of calorimeter = 2.5 kg.  
Mass of water = 1.3 kg.  
Specific heat of water =  $4.187 \text{ KJ kg}^{-1} \text{ K}^{-1}$   
Rise in temperature = 1.8 K.  
% hydrogen in the fuel sample = 2.5, Latent heat = 587 Cal/g. (05 Marks)
- 2 a. i) In a concentration cell, the electrode kept in contact with a solution of lower concentration acts as  
A) Anode B) Cathode  
C) Both anode and cathode D) None
- ii) Example of an ion-selective electrode is  
A) Calomel electrode B) Platinum electrode  
C) Glass-electrode D) Ag-AgCl electrode.
- iii) Calomel electrode is reversible with respect to  
A) Mercuric ion B) Mercury  
C) Chloride ion D) Platinum
- iv) In a galvanic cell, the oxidation takes place at:  
A) Cathode B) Anode  
C) Electrolyte D) Salt bridge. (04 Marks)
- b. What are secondary reference electrodes? Explain construction and working of Calomel electrode. (06 Marks)
- c. Explain determination of pH using glass electrode. (05 Marks)
- d. What are reference electrodes? Explain construction and working of Ag-AgCl electrode. (05 Marks)

- 3 a. i) The fuel cells are more superior than the conventional batteries because  
 A) They are light in weight B) They are eco-friendly  
 C) They produce direct current at low cost D) They are easily fabricated.
- ii) The electrolyte used in Zn-Air battery is  
 A) Aqueous sulphuric acid B) Aqueous potassium hydroxide  
 C) Concentrated potassium chloride D) None of these.
- iii) Which of the following is a reserve battery  
 A) Zn-Air B) Ni-MH  
 C) Zn-Ag<sub>2</sub>O D) Li-MnO<sub>2</sub>
- iv) In lead acid battery, during discharge the product formed at the electrodes is  
 A) PbO<sub>2</sub> B) PbO  
 C) PbSO<sub>4</sub> D) Pb (04 Marks)
- b. Explain the following characteristics of a battery  
 i) Capacity ii) Energy density iii) Cycle life. (06 Marks)
- c. Explain construction, working and applications of Ni-Cd battery. (05 Marks)
- d. Explain the construction and working of methanol – oxygen fuel cell. (05 Marks)
- 4 a. i) Coating used for the iron container used for food package coated with  
 A) Zinc B) Tin  
 C) Lead D) Aluminium
- ii) Water line corrosion in steel tank is an example  
 A) Differential metal corrosion B) Pitting corrosion  
 C) Differential acretion corrosion D) Stress corrosion
- iii) Caustic embrittlement in the boiler is an example of  
 A) Stress corrosion B) Pitting corrosion  
 C) Water line corrosion D) Differential metal corrosion
- iv) Sacrificial anode method of protecting a metal is an example of  
 A) Anodic protection B) Cathodic protection  
 C) Metal coating D) Organic coating (04 Marks)
- b. Define metallic corrosion. Discuss the following factors which affect the rate of corrosion  
 i) Relative areas of anode and cathode ii) pH of the medium. (06 Marks)
- c. What is cathodic protection? Explain cathodic protection by impressed current technique. (04 Marks)
- d. Define corrosion inhibition. Explain anodic and cathodic inhibition, anodic inhibitors with suitable example. (06 Marks)

**PART – B**

- 5 a. i) In the electro plating process, the over voltage potential depends on  
 A) Electrolyte B) Temperature  
 C) Current density D) All of these
- ii) In chromium plating, anode is  
 A) Soluble chromium anodes B) Insoluble anodes  
 C) Inert anodes D) Both B and C
- iii) Auto catalytic reduction method of plating is also known as  
 A) Electroplating B) Electrolysis plating  
 C) Electro less plating D) Electro refining
- iv) For a, electrolytic mixture containing Zn<sup>++</sup>, Cu<sup>++</sup>, Ag<sup>+</sup> the ion which is going to be discharged first is  
 A) Zn<sup>++</sup> B) Cu<sup>++</sup>  
 C) Ag<sup>+</sup> D) None (04 Marks)

- b. Explain decomposition potential and over voltage. Why practical decomposition potential is greater than theoretical decomposition potential. (05 Marks)
- c. Explain electroplating of Nickel. Give the applications. (05 Marks)
- d. Explain electro less plating of copper. (06 Marks)
- 6 a. i) P-azoxy anisole is  
 A) Smectic B) Nematic  
 C) Cholastic D) None
- ii) The mesophases which are formed by heating and cooling cycle are called  
 A) Monotropic phases B) Enantiotropic phases  
 C) Lyotropic phases D) Thermotropic phases.
- iii) In the estimation of FAS by potentiometry the indicator electrode used is  
 A) Silver-silver chloride electrode B) Platinum electrode  
 C) Calomel electrode D) Glass electrode.
- iv) Measurement of optical density using monochromatic light in colorimetry involves  
 A) IR range B) Visible range  
 C) UV range D) All the above. (04 Marks)
- b. Distinguish between thermotropic and lyotropic liquid crystals. Give examples. (04 Marks)
- c. What is homologous series? Explain the liquid crystalline behavior homolog of PAA. (06 Marks)
- d. State Lambert's Law and Beer's law. Explain the colorimetric estimation of copper using  $\text{NH}_3$  as the complexing agent. (06 Marks)
- 7 a. i) A polymer with higher  $T_g$  value is  
 A) PVC B) Poly ethylene C) Poly propylene D) Poly styrene.
- ii) The monomer tetrafluoro ethylene can be used for the preparation of  
 A) PMMA B) Polyurethane C) Teflon D) Polyethylene.
- iii) The polymer which can be used as synthetic adhesive is  
 A) Neoprene B) Buna s C) Epoxy resin D) Polystyrene.
- iv) Co-polymer of Isoprene and butadiene is known as  
 A) Butyl rubber B) Buna s C) PTFE D) Polyurethane. (04 Marks)
- b. Explain addition and condensation polymerization with examples. (06 Marks)
- c. Give the synthesis and uses of i) Epoxy resin ii) Neoprene. (06 Marks)
- d. What is glass transition temperature? Explain any two factors that affect glass transition temperature. (04 Marks)
- 8 a. i) Permanent hardness of water is caused due to the presence of  
 A)  $\text{CaCO}_3$  B)  $\text{Ca}(\text{HCO}_3)_2$  C)  $\text{CaCl}_2$  D) All
- ii) Winkler method is used to determine  
 A) COD B) BOD C) Dissolved oxygen D) Both B and C
- iii) Which of the following alkalinity is not present in water is  
 A)  $\text{CO}_3^{2-} \propto \text{HCO}_3^-$  B)  $\text{CO}_3^{2-} \propto \text{OH}^-$   
 C)  $\text{OH}^-$  only D)  $\text{HCO}_3^-$  and  $\text{OH}^-$
- iv) The method used for desalination of water is  
 A) Lime soda process B) Reverse osmosis  
 C) Ion-exchange process D) Permutit process. (04 Marks)
- b. Explain the determination of permanent and temporary hardness of water by EDTA method. (06 Marks)
- c. Explain gravimetric method of determination of sulfate content in water. (05 Marks)
- d. Explain desalination of water reverse osmosis. (05 Marks)





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### First/Second Semester B.E. Degree Examination, Dec.09/Jan.10 Engineering Chemistry

Time: 3 hrs.

Max. Marks:100

- Note:** 1. Answer any FIVE full questions, selecting at least TWO questions from each part.  
 2. Answer all objective type questions only on OMR sheet page No. 5 of the answer booklet.  
 3. Answers to the objective type questions on sheets other than OMR will not be valued.

#### PART - A

- 1 a. i) If the percentage of hydrogen in a fuel is high, its net calorific value is  
 A) High B) Low  
 C) Constant D) Cannot be predicted.
- ii) Which of the following possesses zero octane number?  
 A) Isooctane B)  $\alpha$  - methyl naphthalene  
 C) n - heptane D) Cyclohexane
- iii) A good fuel should have  
 A) High moisture content B) Low caloric value  
 C) Moderate ignition temperature D) High ash content
- iv) Photovoltaic cell is a  
 A) Storage cell B) Rechargeable cell  
 C) Energy conversion device D) Fuel cell. (04 Marks)
- b. What is knocking in IC engines? Explain its mechanism with chemical reactions. How can it be prevented? (07 Marks)
- c. Explain crystal pulling technique. (03 Marks)
- d. Calculate gross and net calorific value of a coal sample from the following data:  
 Weight of coal sample = 0.98 g  
 Weight of water taken in calorimeter = 2600 g  
 Water equivalent of calorimeter = 368 g  
 Latent heat of steam = 2454 J/g  
 Specific heat of water = 4.187 J/g/K  
 Rise in temperature = 2.8 K  
 Percentage of hydrogen in coal sample = 5.8. (06 Marks)
- 2 a. i) The standard reduction potential of Zn and Fe are - 0.76 V and - 0.44 V respectively. The emf of cell formed by combining the above two electrodes will be  
 A) -0.32 V B) +0.32 V C) +1.2 V D) - 1.2 V.
- ii) Electrode potential of a metal electrode in a dilute solution is  
 A) Same as that in a concentrated solution  
 B) Lower than that in concentrated solution  
 C) Higher than that in a concentrated solution  
 D) Intermediate.
- iii) When the concentration of chloride ion in silver-silver chloride electrode increases, the reduction potential of the electrode  
 A) Increases B) Decreases C) Does not alter D) None of these.
- iv) For a galvanic cell with spontaneous reaction  $E_{cell}$  is assigned  
 A) Positive B) Negative C) Zero D) None of these. (04 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- b. Derive an expression for single electrode potential. (06 Marks)
- c. What are reference electrodes? How do you construct calomel electrode? Write its half cell reaction and advantages. (07 Marks)
- d. The emf of the cell  $\text{cd} \mid \text{cdSO}_4(0.0093\text{M}) \parallel \text{cd}(x\text{M})\text{SO}_4 \mid \text{cd}$  is 0.086 V at 25°C. Find the value of x. (03 Marks)
- 3 a. i) In which of the following, the net cell reaction is irreversible?
- |                          |  |
|--------------------------|--|
| A) Zn - MnO <sub>2</sub> | B) Pb - H <sub>2</sub> SO <sub>4</sub> |
| C) Ni - MH               | D) Ni - Cd.                            |
- ii) To derive maximum voltage from a battery
- The difference in the electrode potential must be high.
  - Internal resistance must be low
  - The over potential at the electrodes must be low
  - All the above
- iii) The electrolyte used in solid oxide fuel cell is
- |  |                             |
|--|-----------------------------|
| A) ZrO <sub>2</sub> + Y <sub>2</sub> O <sub>3</sub>  | B) MnO <sub>2</sub> + ZnO   |
| C) Al <sub>2</sub> O <sub>3</sub> + SiO <sub>2</sub> | D) ZnO + SiO <sub>2</sub> . |
- iv) Which of the following is used in cellular phone?
- |                          |              |
|--------------------------|--------------|
| A) Zn - MnO <sub>2</sub> | B) Pb - acid |
| C) Zn - Air              | D) Ni - MH.  |
- (04 Marks)
- b. Explain the following battery characteristics i) Capacity ; ii) Cycle life. (04 Marks)
- c. Explain the construction and working of Pb - acid battery. (07 Marks)
- d. Explain the construction and working of H<sub>2</sub> - O<sub>2</sub> fuel cell. Why is water formed in the above cell removed continuously? (05 Marks)
- 4 a. i) The flux used in Galvanising is
- |                       |                      |
|-----------------------|----------------------|
| A) NH <sub>4</sub> Cl | B) BaCl <sub>2</sub> |
| C) NaCl               | D) Palm oil          |
- ii) At high hydrogen overvoltage, the rate of corrosion
- |   |                      |
|---|----------------------|
| A) Increases                              | B) Decreases         |
| C) Increases initially and then decreases | D) Remains the same. |
- iii) Caustic embrittlement in boilers is an example of
- |                                 |                      |
|---------------------------------|----------------------|
| A) Differential metal corrosion | B) Pitting corrosion |
| C) Water line corrosion         | D) Stress corrosion  |
- iv) Which of the following factor accounts for lower corrosion rate?
- Large anodic area and small cathodic area
  - Small anodic and large cathodic area
  - High temperature
  - High humidity.
- (04 Marks)
- b. Explain what type of corrosion occurs when
- Steel pipe is connected to copper plumbing
  - Presence of small dust particles on iron surface for a long time.
- (06 Marks)
- c. Explain the effect of following factors on rate of corrosion
- Nature of corrosion product
  - Hydrogen over voltage.
- (06 Marks)
- d. What is meant by anodizing? Explain anodizing of aluminium. (04 Marks)

## PART - B

- 5 a. i) In electroplating, complexing agent is used to  
 A) Prevent passivation of anode  
 B) Prevent the reaction between cathode and plating ion  
 C) Get fine grained and adherent deposit  
 D) All the above
- ii) Which of the following is essential in electroless plating?  
 A) Oxidizing agent                      B) Reducing agent  
 C) Anode                                      D) Electrical energy
- iii) The electrode with lowest hydrogen over voltage is  
 A) Zn    B) Ni  
 C) Hg    D) Pt
- iv) In electroplating, the article to be plated is subjected to pickling. This is to  
 A) Remove grease  
 B) Increase the rate of plating  
 C) Remove oxide scale  
 D) Get a bright deposit. (04 Marks)
- b. Explain the effect of following factors on nature of electrodeposit  
 i) Current density  
 ii) Throwing power. (06 Marks)
- c. Explain electroplating of gold. Mention its applications. (04 Marks)
- d. What is electroless plating? Explain electroless plating of Cu. (06 Marks)
- 6 a. i) Which of the following is the criterion for a molecule to exhibit liquid crystalline behaviour?  
 A) Flexible from one end to the other  
 B) Rigid from one end to the other  
 C) Flexible terminals and rigid central core  
 D) Flexible central core and rigid terminal.
- ii) Which of the following sequential changes occur when liquid crystals of MBBA series are heated?  
 A) Isotropic phase → Smectic phase → Anisotropic phase  
 B) Anisotropic phase → Nematic phase → Isotropic phase  
 C) Anisotropic phase → Isotropic phase → Cholestric phase  
 D) Smectic phase → Anisotropic phase → Isotropic phase.
- iii) Absorbance of light by a solution of substance depends on  
 A) Path length  
 B) Concentration of solution  
 C) Wave length of incident light  
 D) All the above
- iv) Conductometric estimation is based on  
 A) Beer – Lambert's law  
 B) Henderson – Hesselbalch equation  
 C) Nernst equation  
 D) Ohm's law. (04 Marks)
- b. What are liquid crystals? Explain the classification of liquid crystals. (06 Marks)
- c. Explain the principle and application of potentiometry with respect to Redox titration. (07 Marks)
- d. Mention advantages of conductometric titration. (03 Marks)

- 7 a. i) Which of the following is a copolymer?  
 A) Polythene B) Polyurethane  
 C) Teflon D) Plexi glass
- ii) Which of the following is the requirement for conductivity in polymer  
 A) Linear structure B) Presence of oxidizing or reducing agents  
 C) Conjugation D) All these
- iii) Chemical resistance of a polymer decreases with  
 A) Increase in crystallinity B) Increase in cross-linking  
 C) Increase in molecular mass D) None of these
- iv) Micells are formed in  
 A) Bulk polymerization B) Solution polymerization  
 C) Emulsion polymerization D) Suspension polymerization. (04 Marks)
- b. Explain the free radical mechanism of addition polymerization taking ethane as an example. (06 Marks)
- c. Explain the mechanism of conduction in polyacetylene. (04 Mar
- d. Explain the manufacture of following polymers and mention their uses (04 Marks)
- i) Polymethylmethacrylate
- ii) Neoprene. (06 Marks)
- 8 a. i) The reagent used in the estimation of sulphate ions in water is  
 A) Phenoldisulphonic acid  
 B) Zr- SPADNS  
 C) Ammonia  
 D) Barium chloride
- ii) Alkalinity in water is not due to  
 A)  $H^+$  B)  $OH^-$   
 C)  $CO_3^{2-}$  D)  $HCO_3^-$
- iii) Potable water is totally devoid of  
 A) Pathogenic bacteria B) Calcium and magnesium salts  
 C) Chlorides D) Nitrates
- iv) In the determination of dissolved oxygen in water by Winkler's method, sodium ozide is added to  
 A) Liberate  $I_2$  B) Oxidize KI  
 C) Destroy nitrites D) React with starch. (04 Marks)
- b. Explain colourimetric estimation of nitrate ion in water. (05 Marks)
- c. Calculate COD of effluent sample when  $25\text{ cm}^3$  of effluent requires  $8.9\text{ cm}^3$  of  $0.001\text{ M K}_2\text{Cr}_2\text{O}_7$  for complete oxidation. (06 Marks)
- d. Define BOD. Explain activated sludge treatment. (05 Marks)

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**First/Second Semester B.E. Degree Examination, May/June 2010**  
**Engineering Chemistry**

Time: 3 hrs.

Max. Marks:100

- Note:** 1. Answer any FIVE full questions, choosing at least two from each part.  
 2. Answer all objective type questions only on OMR sheet page 5 of the Answer Booklet.  
 3. Answer to objective type questions on sheets other than OMR will not be valued.

**PART – A**

- 1 a. i) In Fischer-Tropsch process, petrol is synthesized using  
 A) Producer gas      B) Water gas      C) Coal gas      D) Natural gas
- ii) Lead tetra ethyl is added to gasoline to  
 A) Increase the octane number      B) Minimize knocking  
 C) Increase the efficiency of IC engine      D) All of these.
- iii) A reference mixture used to find the octane number of gasoline is  
 A) n-heptane and n-octane      B) n-heptane and isooctane  
 C) n-heptane and isobutene      D) n-heptane and n-cetane
- iv) Gasohol is a blend of gasoline with  
 A) Methanol      B) Ethanol      C) Propanol      D) Butanol (04 Marks)
- b. Define gross calorific value and net calorific value. Calculate GCV and NCV from the following data:  
 Mass of the fuel sample used for combustion =  $0.85 \times 10^{-3}$  kg  
 Mass of water in the copper calorimeter = 2.35 kg  
 Water equivalent of calorimeter = 0.45 kg  
 Specific heat of water = 4.187 kJ/kg/K  
 Increase in temperature of water = 3.2°C  
 Latent heat of condensation of steam = 2457 kJ/kg  
 Percentage of hydrogen in the fuel sample = 2.5. (06 Marks)
- c. What is reformation? How reformation enhances octane rating? Illustrate with examples. (05 Marks)
- d. What is photo-voltaic cell? Explain the construction and working of PV cell. (05 Marks)
- 2 a. i) The reference electrode used in the measurement of standard reduction potential is  
 A) Saturated calomel electrode      B) Ag/AgCl electrode  
 C) Glass electrode      D) Standard hydrogen electrode
- ii) The electrode with -ve sign for its SRP acts as  
 A) Anode with respect to SHE      B) Cathode with respect to SHE  
 C) Acts as both      D) None of these
- iii) Potentiometer used for measurement of emf is calibrated using  
 A) Ni-Cd cell      B) Li-MnO<sub>2</sub> cell  
 C) Daniell cell      D) Weston standard Cd-cell
- iv) The emf of a concentration cell with 0.05 M and 0.025 M AgNO<sub>3</sub> solutions is  
 A) 0.178 V      B) 0.0295 V      C) 0.0178 V      D) 0.125 V (04 Marks)
- b. Explain the origin of single electrode potential and derive Nernst equation. (07 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- 2 c. A galvanic cell is constructed by coupling Ag and Cd electrodes dipped in 0.5 M AgNO<sub>3</sub> and 0.25 M CdSO<sub>4</sub> respectively at 25°C. Write the cell scheme, cell reaction, and calculate emf of the cell. Given that SRPs of Ag and Cd are +0.80 V and -0.40 V respectively. (04 Marks)
- d. Give the principle involved in the determination of p<sup>H</sup> using glass electrode and explain the method of determining p<sup>H</sup> using glass electrode. (05 Marks)
- 3 a. i) Which of the following is not a rechargeable battery?  
 A) Ni - Cd                      B) Zn - MnO<sub>2</sub>                      C) Li - MnO<sub>2</sub>                      D) Zn - air
- ii) Li - MnO<sub>2</sub> has higher emf than Zn - MnO<sub>2</sub> battery because  
 A) Li is more electro +ve than Zn                      B) SRP of Li is less than Zn  
 C) Li undergoes oxidation readily                      D) All of these.
- iii) In H<sub>2</sub> - O<sub>2</sub> fuel cell the electrolyte KOH is kept in warm condition to  
 A) Increase the efficiency                      B) Increase the conductivity  
 C) Maintain the electrolyte concentration                      D) Increase the emf
- iv) The fuel cell involving solid electrolyte is  
 A) Molten carbonate                      B) Solid oxide  
 C) Polymer electrolyte                      D) None (04 Marks)
- b. Explain the following battery characteristics:  
 i) Energy efficiency                      ii) Cycle life. (04 Marks)
- c. Why secondary batteries are considered as storage batteries? Explain the construction and working of Nickel-metal hydride battery. Give the reactions involved during discharge and recharge modes. (06 Marks)
- d. How does a fuel cell differ from a battery? Explain the construction and working of methanol-oxygen fuel cell with H<sub>2</sub>SO<sub>4</sub> as electrolyte. Indicate the advantage of H<sub>2</sub>SO<sub>4</sub> as electrolyte over alkali electrolyte. (06 Marks)
- 4 a. i) Pitting corrosion can be explained on the basis of  
 A) Differential aeration                      B) Size of anode and cathode  
 C) Localized corrosion                      D) All
- ii) In anodized aluminum, the corrosion protection is due to  
 A) Passive oxide coating                      B) Phosphate coating  
 C) Chromate coating                      D) None
- iii) Polarisation of anode results in  
 A) Increase in the rate of corrosion  
 B) Decrease in the rate of corrosion  
 C) Increase in the rate of cathodic reaction  
 D) Increase in the rate of anodic reaction.
- iv) Anodic protection can be applied to  
 A) All the metals  
 B) Metals which undergo active-passive transition  
 C) More electro +ve metals  
 D) Less electro +ve metals. (04 Marks)
- b. Explain rusting of iron based on electro chemical phenomenon. (05 Marks)
- c. What is cathodic protection? Explain sacrificial anode and impressed current techniques. (05 Marks)
- d. What are corrosion inhibitors? Explain corrosion inhibition by cathodic inhibitors. Give the reactions involved. (06 Marks)

**PART – B**

- 5 a. i) In the process of electroplating there is  
 A) Electrolysis                      B) Discharge of metal ions at cathode  
 C) Redox reaction                      D) All
- ii) The practical decomposition is greater than the theoretical decomposition potential because of  
 A) Ionisation                      B) Dissociation  
 C) Polarisation of electrodes      D) None
- iii) When an electrolytic mixture containing  $Zn^{++}$ ,  $Cd^{++}$ ,  $Cu^{++}$  and  $Ag^+$  is electrolysed, the ion which is going to be discharged first is  
 A)  $Zn^{++}$                       B)  $Cu^{++}$                       C)  $Cd^{++}$                       D)  $Ag^+$
- iv) The function of the complexing agent in the electrolytic bath is to  
 A) Increase the conductivity  
 B) Maintain metal ion concentration at an optimum level  
 C) Increase in the metal ion concentration  
 D) None. (04 Marks)
- b. Explain the effect of the following on the nature of electro deposit:  
 i) Current density                      ii)  $p^H$                       iii) Throwing power. (06 Marks)
- c. Explain the process of electroplating of chromium for engineering applications. Indicate the reasons for not employing chromium as anode. (05 Marks)
- d. What is electroless plating? Explain electroless plating of nickel. (05 Marks)
- 6 a. i) Para Azoxy Anisole is an example for  
 A) Cholestric                      B) Smectic  
 C) Chiral nematic                      D) Nematic
- ii) In potentiometer calomel electrode is used in combination with  
 A) Glass electrode                      B) Ag/AgCl electrode  
 C) Pt-electrode                      D) Quinhydrone electrode
- iii) Liquid crystals are  
 A) Isotropic                      B) Optically anisotropic  
 C) Optically isotropic                      D) All
- iv) In flame photometry the emitted radiation lies in  
 A) IR range                      B) UV range  
 C) Visible range                      D) All the three. (04 Marks)
- b. What are thermotropic and lyotropic liquid crystals? Give examples. (04 Marks)
- c. Define specific conductance. Explain conductometric estimation of HCl using standard solution of NaOH. (05 Marks)
- d. State and explain Lambert's law and Beer's law. Explain in brief the estimation of copper by colorimetric method. (07 Marks)
- 7 a. i) Natural rubber is the polymerized form of  
 A) Chloroprene                      B) Isoprene                      C) Propene                      D) Styrene
- ii) Condensation polymerization is  
 A) Homo polymerisation                      B) Chain polymerisation  
 C) Copolymerisation with elimination      D) Copolymerisation without elimination
- iii) Glass transition temperature of polymer is  
 A) First order transition                      B) Second order transition  
 C) Inner transition                      D) Poly order transition.

- 7 a. iv) In suspension polymerization the monomer droplets are stabilized by using  
 A) Emulsifying agent B) Coagulants  
 C) Anticoagulants D) Deemulsifying agent (04 Marks)
- b. Explain free radical mechanism of addition polymerization taking ethane as monomer. (04 Marks)
- c. Give the polymerization reaction involved in the synthesis of the following polymers:  
 i) Plexiglass ii) Polyurethane iii) Epoxy resin iv) Butyl rubber (08 Marks)
- d. What are conducting polymers? Explain conduction mechanism in doped poly acetylene. (04 Marks)
- 8 a. i) Permanent hardness of water is due to  
 A)  $\text{Ca}(\text{HCO}_3)_2$  B)  $\text{CaCO}_3$  C)  $\text{CaSO}_4$  D)  $\text{MgCO}_3$
- ii) Indicator used in the determination of chloride using  $\text{AgNO}_3$  is  
 A)  $\text{K}_3[\text{Fe}(\text{CN})_6]$  B)  $\text{K}_4[\text{Fe}(\text{CN})_6]$  C)  $\text{K}_2\text{CrO}_4$  D)  $\text{K}_2\text{Cr}_2\text{O}_7$
- iii) Excessive fluoride in water leads to  
 A) Dental carries B) Silicosis C) Fluorosis D) All
- iv) The method adopted to convert saline water into potable water is  
 A) Demineralisation B) Ion exchange process  
 C) Permutit process D) Electrodialysis (04 Marks)
- b. Explain Winkler's method of determining dissolved oxygen. Give the reactions involved. (05 Marks)
- c. What is desalination? Explain desalination of water by reverse osmosis. (06 Marks)
- d. While analyzing a water sample to determine alkalinity, 100 ml of sample water consumed 12.4 ml of  $\frac{\text{N}}{50} \text{H}_2\text{SO}_4$  till phenolphthalein end-point. On further titration of the reaction mixture using methyl orange indicator, the total consumption of  $\frac{\text{N}}{50} \text{H}_2\text{SO}_4$  was 17.8 ml. Determine the type and extent of alkalinity. (05 Marks)

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