

First/Second Semester B.E. Degree Examination, June/July 2011
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 on OMR sheet only.

PART - A

- 1 a. i) If the direction of flow of electrons in a galvanic cell is left to right then the name of cell reaction is
 A) Reversible B) Irreversible C) Non - spontaneous D) Spontaneous.
- ii) Standard hydrogen electrode cannot be used in the presence of
 A) Reducing agent B) Oxidising agent C) Water diluting agent D) All of these.
- iii) Calomel electrode is reversible with respect to
 A) Calomel B) Mercury C) Chloride ions D) None of these
- iv) Glass electrode can be used with out an error upto a P^H of
 A) 4 B) 14 C) 9 D) 12. (04 Marks)
- b. Derive Nernst equation for the potential of an electrode. (05 Marks)
- c. Calculate the voltage of a cell which consists of a rod of iron immersed in a 1.0 M solution of $Fe SO_4$ and a rod of manganese immersed in a 0.1 M solution of $Mn S_4$ at $25^\circ C$. Write the cell reaction. Give $E^\circ_{Fe^{2+}/Fe} = -44 V$ and $E^\circ_{Mn^{2+}/Mn} = -1.18 V$. (05 Marks)
- d. Discuss the construction and working of glass electrode to determine the P^H of a solution. (06 Marks)
- 2 a. i) Double sulphate theory of lead - acid battery is proposed by
 A) Nernst B) Faraday C) Glaston and taube D) Melmholtz.
- ii) Oxidation of methanol in methanol - oxygen fuel cell is a process of
 A) one electron B) Four electrons C) two electrons D) Six electrons
- iii) Active material for anode in Nickel - Metal hydride battery is
 A) $Ni.OH$ B) $Ni(OH)_2$ C) H_2 D) None of these
- iv) Electrolyte used in lithium batteries is
 A) Aqueous B) Mixture of aqueous and non aqueous C) Non - aqueous
 D) None of these. (04 Marks)
- b. Discuss the construction and working of zinc- air battery. (05 Marks)
- c. Explain the following battery characteristics
 A) Voltage B) cycle life C) Energy efficiency. (06 Marks)
- d. Discuss the construction and working of hydrogen - oxygen fuel-cell. (05 Marks)
- 3 a. i) Alkali and alkaline earth metals form an oxide
 A) Protective B) Highly adherent C) Non -porous D) Porous.
- ii) Caustic embrittlement is an example of corrosion of
 A) Differential metal B) differential aeration C) Stress D) Waterline.
- iii) Intense corrosion takes place when
 A) Smaller cathodic area B) Larger anodic area C) Larger cathodic area
 D) Smaller anodic area.
- iv) Copper containers to store the foodstuffs are coated with
 A) Zn B) Al C) Sn D) Ni. (04 Marks)
- b. Discuss the electrochemical theory of corrosion taking iron as corroding metal. (05 Marks)
- c. Explain the following types of corrosion
 A) Differential metal B) Waterline C) stress. (06 Marks)
- d. Discuss the sacrificial anode and impressed current methods of corrosion control. (05 Marks)

- 4 a. i) Technological importance of metal finishing is to impart
 A) Corrosion resistance B) Solderability C) Thermal resistance D) all of these.
 ii) The moderate temperature range of the bath composition for good electrodeposit is
 A) 20 - 30°C B) 70 - 80° C) 35 - 60°C D) none of these.
 iii) Use of complexing agent during electrodeposition is to
 A) Obtain lustrous deposit
 B) Release the gas bubbles from the deposit surface
 C) Reduce the concentration of plating ions if high
 D) Increase the current density.
 iv) Driving force of electroless plating is
 A) Power supply B) Oxidising agent C) Autocatalytic redox reaction D) None of these. (04 Marks)
- b. Explain the following variables which influence the nature of deposit
 A) Current density B) P^H of the electrolytic bath
 C) Throwing power of the plating bath. (06 Marks)
- c. Explain the process of electroplating of chromium for decorative chromium. (04 Marks)
- d. Discuss the process of electroless plating of copper and explain its application in the manufacture of PCB. (06 Marks)

PART - B

- 5 a. i) Catalyst used in fluidized catalytic cracking is
 A) Pt B) Cr_2O_3 C) Al_2O_3 D) Al_2O_3 and SiO_2 .
 ii) Reformation of petrol involves
 A) Hydrogenation B) Oxidation C) Hydrocracking D) None of these.
 iii) Antiknocking value of petrol can be increased by
 A) amyl nitrite B) Acetone peroxide C) Ethyl nitrite D) Ethyl - t - butyl ether.
 iv) Photovoltaic cell devices convert
 A) Chemical energy into electrical energy
 B) Electrical energy into chemical energy
 C) Sunlight energy into electrical energy
 D) None of these. (04 Marks)
- b. Discuss the process of fluidized catalytic cracking of heavy oil. (06 Marks)
- c. Explain the working of photovoltaic cell. (05 Marks)
- d. On burning 1.15g of a coal sample in a bomb calorimeter, the temperature of 3.5 kg of water in the calorimeter increased from 26.5°C to 28.5°C. Water equivalent of calorimeter is 325 g. Specific heat of water is 4.187 J/g/k and latent heat of steam is 2458 J/g. If the fuel contains 4% hydrogen, calculate its gross and net calorific values. (05 Marks)
- 6 a. i) The number of degree of freedom of a system having equilibrium with ice, liquid water and water vapour is
 A) 1 B) 3 C) 2 D) zero.
 ii) The process of raising the relative proportion of silver in the alloy is known as
 A) Gibb's process B) Pattinson's process C) Beer's process D) Plante's process.
 iii) The equation of condensed phase rule is
 A) $F = C - P + 2$ B) $F = C - P + 3$ C) $F = C - P + 1$ D) None of these.
 iv) The law states that current flowing in a conductor is directly proportional to the resistance of the conductor is known as
 A) Lambert's law B) Bedworth's law C) Ohm's law D) Faraday's law. (04 Marks)
- b. Explain the terms phase, component and degree of freedom involved in the statement of phase rule. (06 Marks)
- c. Explain the applications of phase rule over lead - silver system. (05 Marks)
- d. Discuss the theory and instrumentation of conductometric electroanalysis. (05 Marks)

- 7 a. i) Termination of polymerization is by
 A) Combination of growing chains
 B) Combination of growing chain with free radical of initiator
 C) Disproportionation
 D) All of these.
- ii) As flexibility of polymer increases, T_g
 A) Increases B) Ceases C) Decreases D) None of these.
- iii) Polyurethanes are characterized by the presence of
 A) $-\text{CH}_2-\text{O}-\text{CH}_2-$ B) $-\text{NH}-\text{CO}-$ C) $-\text{O}-\text{CO}-\text{O}-$ D) $-\text{NH}-\text{CO}-\text{O}-$.
- iv) Neoprene is closely related to
 A) Nitrile rubber B) Butyl rubber C) Natural rubber D) Buna-S rubber. (04 Marks)
- b. Discuss the free radical mechanism of polymerization taking ethylene as a monomer. (04 Marks)
- c. Give the synthesis of
 A) PMMA B) EPOXY resin C) Butyl rubber. (06 Marks)
- d. What are conducting polymers? Discuss the mechanism of oxidative doping of polyacetylene. (06 Marks)
- 8 a. i) Permanent hardness of water is caused by
 A) Sodium chloride
 B) Calcium bicarbonate
 C) Potassium sulphate
 D) Magnesium sulphate.
- ii) Sea water can be desalinated by
 A) Boiling B) Limesoda process C) Electrodialysis D) None of these.
- iii) Alkalinity of water is due to the presence of
 A) OH^- ions B) CO_3^{2-} ions C) HCO_3^- ions D) All of these.
- iv) General impurities present in water are
 A) Organic matters
 B) Pathogenic bacterias
 C) calcium sulphate
 D) All of these. (04 Marks)
- b. Discuss the determination of sulphate in water by using benzidine hydrochloride. (06 Marks)
- c. Define BOD and COD. Calculate the BOD when 1 litre of effluent from sugar industry containing 150 mg of glucose was completely oxidized into CO_2 and H_2O . (06 Marks)
- d. Explain the desalination of water by reverse osmosis process. (04 Marks)
