First/Second Semester B.E. Degree Examination, Dec.2015/Jan.2016
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 sheet will not be valued.*

PART – A

1 a. Choose the correct answers for the following : **(04 Marks)**
   i) Nernst equation is based on
       A) Thermodynamic principle   B) An equation for oxidation and reduction potential
       C) Increase in free energy of the system   D) All of these.
   ii) In a concentration cell a potential is produced because of
       A) Transfer of ions from lower concentration to higher concentration
       B) Transfer of ions from higher concentration to lower concentration
       C) Oxidation at anode
       D) Mixing of two solutions
   iii) 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.
   iv) In a galvanic cell, the reaction taking place at cathode is
       A) reduction   B) oxidation   C) both A and B   D) None of these.

   b. Define standard electrode potential. Explain the origin of electrode potential. **(06 Marks)**
   c. What is an ion-selective electrode? Explain the method of determining the pH of a given solution using Glass electrode. **(06 Marks)**
   d. An electrochemical cell consists of copper electrode dipped in 0.5M $CuSO_4$ and silver electrode dipped in 0.25 M $AgNO_3$. Write the cell representation, half cell and net cell reactions and calculate the emf of the cell at 298 K. Given standard reduction potential of copper and silver electrodes are +0.34V and +0.80V respectively. **(04 Marks)**

2 a. Choose the correct answers for the following : **(04 Marks)**
   i) The capacity of the battery is often expressed in terms of
       A) Volts   B) Ampere hours   C) Newton   D) Ergs
   ii) The voltage of the battery depends on
       A) Electrode potential   B) Net change in free energy of the cell reaction
       C) Both A and B   D) Type of electrodes used.
   iii) The electrolyte used in Ni-MH cell is
       A) Aq. H_2SO_4 B) Aq. KOH   C) Con. KCl   D) Aq. NaOH
   iv) Fuel cells convert
       A) Heat energy to electrical energy   B) Chemical energy to electrical energy
       C) Mechanical energy to electrical energy   D) None of these.

   b. Describe the construction and working of Nickel – Cadmium battery. **(06 Marks)**
   c. Describe with reactions the construction of hydrogen-oxygen fuel cell. **(06 Marks)**
   d. Explain the construction and working of Li-MnO_2 battery. **(04 Marks)**

3 a. Choose the correct answers for the following : (04 Marks)
   i) During corrosion, the gas produced in acidic medium is
      A) Hydrogen   B) Oxygen   C) Nitrogen   D) Carbon dioxide

   ii) Iron article is coated with zinc to prevent corrosion, the process is
      A) Inorganic coating B) Anodic coating   C) Cathodic coating D) Painting
   iii) Pitting corrosion is an example of
      A) wet corrosion   B) corrosion in presence of water and oxygen
      C) Differential aeration corrosion   D) None of these
   iv) During galvanic corrosion, the noblest metal acts as
      A) Anode   B) Cathode   C) both A and B   D) corroding metal

   b. Explain differential metal corrosion with examples. (06 Marks)
   c. Discuss the factors that influence the rate of corrosion. (06 Marks)
   d. Describe Tinning process of preventing corrosion. (04 Marks)

4 a. Choose the correct answers for the following : (04 Marks)
   i) Brighteners are added to plating bath in order to
      A) have uniform deposit   B) increase brighteness
      C) make grain size of the deposit small than λ of light   D) Remove colour
   ii) The anode used in chromium plating is
      A) A pure chromium metal   B) A pure copper
      C) An alloy of lead and antimony   D) Any alloy of chromium
   iii) In electroplating, the article to be plated is subjected to pickling to
      A) remove grease   B) increase the rate of plating
      C) get a bright deposit   D) remove oxide scale.
   iv) Conductors and insulators can be plated by
      A) Electroplating   B) Electroless plating   C) both A and B   D) Electro polishing

   b. What is metal finishing? Describe the method of electroplating process. (06 Marks)
   c. Discuss how the various constituents of plating bath solution affect the nature of electrodeposit. (06 Marks)
   d. Describe the method of electroless plating of nickel on copper article. (04 Marks)

PART – B

5 a. Choose the correct answers for the following : (04 Marks)
   i) Catalyst used in catalytic converters are
      A) Ni, Co and Cr   B) Pt, Pd and Rh   C) Al_2O_3 and SiO_2 D) Zeolite
   ii) Quality of a diesel is measured by its
      A) Cetane no.   B) Octane no.   C) Heptane no.   D) Carbon no.
   iii) Majority charge carrier in p-Type semiconductors is
      A) Ions   B) Electrons   C) Hole   D) Atoms
   iv) The tendency of knocking is high in
      A) Aromatics   B) Olefins   C) Straight chain hydrocarbons D) Cycloparaffins

   b. What is reforming of Petrol? Discuss the various methods of reforming. (06 Marks)
   c. Write a brief note on (i) Power alcohol (ii) Photovoltaic cell. (06 Marks)
   d. Calculate the GCV and NCV of a fuel sample with the following data. Weight of fuel sample = 5.5×10^{-3} kg, weight of water in the calorimeter = 2.5 kg, Water equivalent of calorimeter = 0.5 kg, Rise in temperature = 4°C, percentage of hydrogen in the fuel = 2.8 and Latent heat of steam = 2454 kJkg^{-1}. (04 Marks)

6 a. Choose the correct answers for the following : **(04 Marks)**
  i) The degree of freedom for water in equilibrium with its vapour is
    A) 2   B) 1   C) 3   D) 0
  ii) In potentiometric estimation of FAS, the indicator electrode is
    A) Silver-Silver chloride electrode   B) Calomel electrode
    C) Glass electrode   D) Platinum electrode
  iii) Flame photometer is based on
    A) Atomic absorption   B) Molecular absorption
    C) Atomic emission   D) All of these.
  iv) The structure of r-iron is
    A) Body centered cubic   B) Face centered cubic
    C) Simple cubic   D) None of these

  b. State the condensed phase rule for two component system. Discuss the phase diagram for Lead-Silver system. **(06 Marks)**
  c. What are eutectic and eutectoid points with respect to Fe-C system? **(04 Marks)**
  d. Discuss the instrumentation and applications of colorimetric estimation. **(06 Marks)**

7 a. Choose correct answers for the following : **(04 Marks)**
  i) Polymer obtained from alkyl di-isocynates and dihydric alcohol is
    A) Poly tetra fluoro ethylene   B) Poly methyl methacrylic acid
    C) Epoxy Resin   D) Polyurethane
  ii) The most conducting and useful form of polyaniline is
    A) Leucoemarldine   B) Emeraldine salt   C) Emeraldine base   D) Pernigraniline.
  iii) The starting material used in the manufacture of carbon fibre is
    A) Polyacrylnitrile   B) Epichlorohydrin   C) Bisphenol-A   D) Butadiene.
  iv) The conductivity in polymers is due to
    A) Many double bonds   B) Many rings in the chain
    C) Long extended conjugation   D) Long extended conjugation and doping .

  b. Discuss the methods of polymer moulding. **(06 Marks)**
  c. Give the synthesis and applications of (i) Phenol-formaldehyde resin (ii) Epoxy Resin. **(06 Marks)**
  d. What are the deficiencies of natural rubber? Explain the synthesis of Neoprene. **(04 Marks)**

8 a. Choose the correct answers for the following : **(04 Marks)**
  i) The presence of fluoride in water is determined by
    A) Volumetric method   B) Calorimetric method
    C) Gravimetric method   D) None of these.
  ii) In reverse osmosis
    A) Sea water is purified   B) Sewage water is purified
    C) Industrial waste water is purified   D) River water is purified.
  iii) Units for expressing alkalinity of a water sample is
    A) mg/l of $MgCO_3$ B) mg/l of $Ca(OH)_2$ C) mg/l of $CaCO_3$ D) None of these.
  iv) In the secondary treatment of sewage, oxidation of impurities is carried by
    A) Potassium dichromate   B) Microbes
    C) Ferrous ammonium sulphate   D) any of the above.

  b. What are the types of impurities present in natural water? Explain. **(04 Marks)**
  c. Explain the method of determination of the following in water (i) Sulphates (ii) Dissolved oxygen. **(08 Marks)**
  d. 25 cc of waste water sample was mixed with 25 cc of $K_2Cr_2O_7$, acidified and refluxed. The unreacted $K_2Cr_2O_7$ acidified required 8.2 cc of 0.2 NFAS. In a blank titration 25cc of $K_2Cr_2O_7$ acidified required 15.4 cc of same FAS. Calculate COD of the waste water sample. **(04 Marks)**

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