FE 1 – 2 (RC)

F.E. Semester – I Examination, Nov. / Dec. 2008
(Revised in 2007 – 08)
APPLIED SCIENCE – I (Physics and Chemistry)

Duration : 3 Hours | Total Marks: 100

Instructions : *1) Answer **one question from each module.***
*2) Answer **the two sections in separate answer books.***
*3) Draw diagrams **wherever** required.*
*4) Assume additional data **if required.***

SECTION – I **(Physics)**
MODULE – I

1. a) Why is an extended source of light preferred to a point source while studying interference in thin films ? **5**

   b) Briefly discuss the concept of carrier diffusion in a semiconductor and hence derive an expression for total current density due to diffusion and drifting of charge carriers. **5**

   c) In case of an antireflection coating, prove that the minimum thickness of the film should be quarter wavelength of incident light. **5**

   d) Briefly explain the physical origin of Hall effect. Derive an expression for hall voltage and hence explain the use of hall effect in identifying the type of semiconductor. **10**

2. a) Show that the diameter of dark circular Newtons rings are proportional to square root of natural numbers in reflected light. **5**

   b) Briefly discuss the theory of direct recombination of charge carriers in a semiconductor. Obtain an expression for recombination of minority carriers in a semiconductor.

P.T.O.

c) A parallel beam of sodium light ($\lambda = 5890\ A^{\circ}$). Strikes a film of oil floating on water. When viewed at an angle of 30° from the normal, an 8th dark band is seen. Determine the thickness of the film. (Given - refractive index of oil = 1.5) 5

d) Explain the formation of interference fringes by means of wedge shaped film. Derive an expression for fringe width in a wedge shaped film in terms of wedge angle and wavelength of light used. Briefly explain the experimental method to determine the diameter of a thin wire using wedge shaped film. 10

MODULE – II

3. a) State the applications of ultrasonic waves using the principle of i) echosounding and ii) cavitation. 5

b) Describe any two methods for the detection of ultrasonic waves. 5

c) Explain electrostatic focussing. 5

d) How will you distinguish between ionisation chamber, proportional counter and GM counter ? Describe the principle and working of Geiger - Muller Counter. Mention it's use. 10

4. a) Draw the block diagram of a CRO. Briefly explain use of CRO to determine frequency of ac mains. 5

b) Describe the principle and working of ionisation chamber. Mention its use. 5

c) Explain the working of a magnetic lens. 5

d) What is magnetostriction effect ? Draw circuit diagram of magnetostriction oscillator and explain its working. Mention the advantage of this method over Piezoelectric method. 10

SECTION – II
MODULE – III

5. a) A Galvanic cell to be operated at 25° C is set up using the elements Mg and Cu. Write its cell representation and chemical reactions involved in the cell. Also find the emf of the cell assuming that $MgSO_4$ (0.01M) and $CuSO_4$ (0.05 M) were used as electrolytes. Given : $E^0_{Mg} = -2.37$ V and $E^0_{Cu} = 0.34$ V. 8

b) State and explain any four characteristics of Batteries. 8

c) Give the construction and working of $H_2 - O_2$ fuel cell. 5

d) Write the Nernst equation for the electrode system $Ni / Ni^{2+}_{(0.05M)}$. Also find its single electrode potential at 25° C. Given : $E^0_{Ni} = -0.23$V. 4

6. a) Give the construction and working of Ni - MH batteries. Explain the role of Hydrogen absorbing alloys in its functioning. 8

b) The following cell $Mg/Mg^{2+}_{(0.001M)} // Mg^{2+}_{(0.01M)} / Mg$ was used in order to obtain electrical energy. State the principle behind working of this cell and explain its working with the help of neat diagram. Also find its emf. Given : $E^0_{Mg} = -2.37$ V. 8

c) Explain the working of an alkaline fuel cell with the help of a neat diagram. 5

d) Write the Nernst equation for the electrode system $Cu^{2+}_{(0.05M)}/Cu$. Also find its single electrode potential. Given : $E^0_{Cu} = 0.34$ V. 4

MODULE – IV

7. a) Explain any two corrosion protection methods involving metal coatings, most widely used for protection of iron metal. 8

b) Explain the process of electroless plating of a non-metallic surface using Ni as the coating metal. 8

c) Outline the technological importance behind metal finishing's. 5

d) Explain in brief any four factors affecting the rate of corrosion. 4

8. a) An alloy made up of copper and zinc was found to undergo corrosion under service conditions. State and explain at least four possible modes of corrosion which may be due to inherent and external forces, this alloy can suffer corrosion. All possible type of environmental conditions can be assumed. **8**

b) State and explain any four plating variables which can alter the nature of metal deposit obtained by using the process of Electroless plating. **8**

c) Explain the importance of polarization of electrodes and Decomposition Potential in the Process of Electroplating. **5**

d) Explain the type of corrosion a tank made of iron, used for storing water most likely to undergo. **4**
