SEM 1 – 2 (RC 07 – 08)

F.E. (Semester – I) (Revised in 2007 – 08) Examination, May/June 2012
APPLIED SCIENCE – I
Physics and Chemistry

Duration : 3 Hours Total Marks : 100

Instructions : 1) *Answer **one** question from **each** Module.*
2) *Answer physics and chemistry Sections in **separate** answer books.*
3) *Draw diagrams **wherever** required.*
4) ***Assume** additional data **if required**.*

SECTION – I
(Physics)
Module – I

1. a) Obtain an expression for conductivity and resistivity of an intrinsic semiconductor in terms of carrier mobilities and carrier concentration. 5

   b) Newtons rings are formed with reflected light of wavelength 589 nm. With a liquid between lens and glass plate, the diameter of the sixth bright ring is 0.3 cm. Determine refractive index of the liquid if radius of curvature of the lens is 102 cm. 5

   c) Write a short note on antireflection films. Briefly explain amplitude and phase requirement in such films. 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 give an account for experimental method to determine the diameter of a thin wire using wedge shaped film. 10

2. a) Briefly explain physical origin of Hall effect and hence derive an expression for Hall coefficient. 5

   b) Prove that in reflected light, radii of dark circular Newtons rings are proportional to square root of natural number. 5

   c) Resistivity of an extrinsic semiconductor specimen is found to be $9 \times 10^{-3}\ \Omega$ m. The Hall coefficient of the sample was measured to be $3.5 \times 10^{-4}\ m^3/C$. Determine mobility and density of charge carriers assuming a single carrier conduction process. 5

   d) What is continuity equation ? Derive equation of continuity for excess carrier in a semiconductor. 10

P.T.O.

Module – II

3. a) Briefly explain the principle of following : 5

   i) Quenching in GM Counter

   ii) Cavitation by ultrasonic waves.

   b) Discuss electrostatic focussing. Give one application of it. 5

   c) An ultrasonic transducer of frequency 100 MHz is used to make acoustic grating out of water column in a vertical tube closed at one end. A monochromatic light of wavelength 590 nm is used to form first order diffraction at an angle of $2°, 15'$. Determine velocity of ultrasonic waves. 5

   d) Draw the block diagram of a CRO and explain its working. How can you use CRO to measure frequency of ac mains. 10

4. a) Briefly explain acoustic diffraction method for detection of ultrasonic waves. 5

   b) Explain direct and inverse piezoelectric effect. Draw circuit diagram of a piezoelectric oscillator and explain its working. 5

   c) Explain the basic principle of following : 5

   i) Magnetic lens

   ii) Echosounding.

   d) Describe principle and working of a GM Counter. Why is quenching carried out in it ? Explain how a GM Counter differ from a proportional counter and ionisation chamber. 10

SECTION – II
(Chemistry)
Module – III

5. a) Derive Nernst equation. Explain the terms involved. Write the cell reactions and calculate the emf of the following cell. $Cd_{(s)} \left| Cd^{2+}{}_{(0.01\,M)} \right| \left| Cu^{2+}{}_{(0.5\,M)} \right| Cu$.

   Given : Standard reduction potential of Cd and Cu are –0.40 V and 0.34 V respectively. 8

   b) Explain how glass electrode can be used for pH determination of a solution. 8

   c) What is a 'polymer electrolyte' fuel cell ? Explain its working. 5

   d) Calculate the emf of the cell consisting of silver electrodes, one immersed in a solution of 0.043 M and the other immersed in a solution of 0.00475 M solution of its ions. Explain the working principle of the cell. 4

6. a) With the help of a neat diagram explain the working of Zn-air battery. 8

   b) The following cell $Mg\,|Mg^{2+}_{(0.001M)}\|Mg^{2+}_{(0.01M)}|\,Mg$ was used to obtain electrical energy. State the principle behind the working of this cell and explain its working with the help of neat diagram. 8

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

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

Module – IV

7. a) Explain any four methods by which corrosion can be controlled or avoided. 8

   b) Explain the electrochemical mechanism of corrosion. 8

   c) Explain the basic set up of an electroplating bath with the help of a suitable example. 5

   d) Explain the process of PCB preparation using electroless method. 4

8. a) Outline the various factors due to nature of metal which affects the corrosion rate. 8

   b) Explain the process of Galvanizing and tinning with the help of a neat labeled diagram. 8

   c) Outline the various constituents of a electroless plating bath. 5

   d) Describe the process of electroplating of chromium. 4