



SEM 1 – 2 (RC 07-08)

F.E. (Semester – I) (Revised in 2007-08) Examination, Nov./Dec. 2015 APPLIED SCIENCE – I (Physics and Chemistry)

Duration : 3 Hours

Total Marks : 100

- Instructions :** 1) Answer **one** question from **each** Module.
2) Answer **each** Section in **separate** answerbook.
3) Draw diagrams **wherever** required.
4) **Assume** additional data **if required**.

SECTION – I (Physics)

Module – I

1. a) Derive the expression for conductivity of an intrinsic semiconductor in terms carrier concentration and carrier mobility. 5
- b) Show that the diameters of dark circular Newton's rings for reflected light are proportional of square root of natural numbers. 5
- c) Explain how the planeness of a surface can be checked by using interference technique. 5
- d) i) What is Hall effect ? 10
ii) A Hall effect device has the following geometry $L = 0.5$ cm (x-dir), $d = 0.05$ cm (y-dir), $w = 0.01$ cm (z-dir), electrical parameters are $I_x = 2.5$ mA, $V_x = 2.2$ V and $B_z = 2.5 \times 10^{-2}$ Tesla. The Hall voltage $V_H = -4.5$ mV.
Find :
 - a) Conductivity type
 - b) Hall field intensity
 - c) Majority carrier concentration
 - d) The mobility
 - e) The resistivity.

P.T.O.



2. a) Explain the concept of carrier diffusion in a semiconductor. Derive the expression for diffusion current densities. 5
- b) Why antireflection film is needed for a good camera lens ? Prove that the minimum thickness of antireflection film should be quarter wavelength thick ? 5
- c) Derive the expression for fringe width in a wedge shaped film. 5
- d) Explain briefly :
 - i) Phase change at Reflection
 - ii) Optical path and Geometric path. 5
- e) A wedge shaped air-film is formed with two glass plates inclined at an angle of 40 min. If the light of wavelength 4655 AU falls normally on the film, what will be the fringe width ? If water ($R. I. = 1.33$) is filled between the plates, what will be the fringe width now ? 5

Module – II

3. a) What is piezoelectric effect ? With the help of circuit diagram, explain the working of piezoelectric oscillator. 5
- b) Write down any three properties of ultrasonic waves. Explain any one marine application of U. S. waves. 5
- c) Explain how voltage and frequency of ac signal can be measured with the help of CRO. 5
- d) Describe the construction and working of GM counter. Explain why the quenching is necessary in this counter. Also give any two differences between ionization chamber and GM counter. 10
4. a) Explain the principle and working of electrostatic lens. 5
- b) What is magnetostriction ? Explain the working of magnetostriction oscillator to produce U.S. waves. 5
- c) Describe the construction and working of ionization chamber. 5
- d) Explain why sawtooth voltage is required to display the waveform of any signal on a CRO screen.

Explain how the blanking of retrace path is achieved. A sine wave voltage of frequency 150 Hz is fed to the vertical input and simultaneously a sawtooth voltage of frequency 100 Hz is fed to the horizontal input of a CRO. Explain with a neat diagram what display you would get on the screen ? 10



SECTION – II
(Chemistry)

Module – III

5. a) Construct a galvanic and concentration cell by taking suitable elements and electrolyte concentration and determine the resultant EMF. Also write the representation and reactions involved in the cells. 6
- b) With the help of a neat labeled diagram explain the construction and working of a Zinc based primary battery system. 5
- c) Derive the expression for determination of single electrode potential. 5
- d) Describe the functioning of fuel cell system with solid oxides as electrolyte. 5
- e) Determine the electrode potential for the following system $\text{Al} \mid \text{Al}^{3+} (0.01\text{M})$ (Given $E^\circ_{\text{AC}} = -1.66 \text{ V}$). 4
6. a) Illustrate the use of ion selective electrode in analysis of ions in a given sample. 6
- b) Calculate the EMF of the following :
- i) The cell formed by dipping Zn rod in 0.01 M Zn^{2+} solution and Ni rod in 0.1 M Ni^{2+} solution. ($E^\circ_{\text{Zn}} = -0.76 \text{ V}$ and $E^\circ_{\text{Ni}} = -0.25 \text{ V}$). 5
- ii) Ag electrodes dipped in Ag^+ solution of 0.1M and 0.01 M concentrations.
- c) Describe the functioning of polymer based electrolyte fuel cell. 5
- d) With the help of a neat labeled diagram explain the construction and working of a Ni based secondary battery system. 5
- e) Define the term electrode potentials and standard electrode potential. 4

Module – IV

7. a) Outline the mechanism involved in electrochemical process of corrosion when metal is in contact with a solution of neutral pH. Give suitable example. 6
- b) Explain stress and Intragranular type corrosion by taking suitable examples. 5
- c) Explain the basic set up of an electroplating bath for the purpose of plating an object with chromium. 5
- d) Explain how metallic structure can be protected from corrosion by using corrosion inhibitors and by using suitable design aspects. 5
- e) Explain how the nature of oxide layer formed on the metal surface affects the further corrosion activity on the metal. 4



8. a) Explain any two types of corrosion by giving suitable examples. 6
- b) A metal tub used for filling water was observed to have undergone corrosion. Incidentally the surface below the water level had undergone more corrosion process. Explain the type of corrosion this metal has most likely undergone with necessary reactions. 5
- c) Outline the various constituents of electroless plating bath with suitable examples. 5
- d) Explain the process of tinning with the help of a neat labeled diagram. 5
- e) Outline the importance of metal finishing. 4
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