SEM 1 – 2 (RC 07-08)

F.E. (Semester – I) (Revised 2007-08) Examination, Nov./Dec. 2010
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) What are antireflection films ? Explain phase and amplitude requirement in such films. **5**

   b) Derive the condition of dark interference fringes due to transmitted light from a thin film. **5**

   c) Light of wavelength 6000 A° is used to observe Newton's rings with reflected light. The diameter of 15^{th} dark ring is recorded as 0.55 cm. Determine the radius of 40^{th} dark ring and radius of curvature of the lens used. **5**

   d) Briefly discuss the physical origin of Hall effect. Derive an expression for Hall voltage and Hall coefficient. How does Hall effect helps in identifying the type of semiconductor ? **10**

2. a) Derive an expression for fringe width of interference fringes formed in a wedge shaped thin film of air. **5**

   b) Give an account of carrier diffusion in a semiconductor. Derive an expression for total current density due to drifting and diffusion of charge carriers. **5**

P.T.O.

c) A thin film of refractive index 1.3 is illuminated by white light incident at an angle of 55°. The light reflected by it is examined by a spectroscope in which a dark band corresponding to wavelength 5000 A° is seen. Calculate the order of the interference band if thickness of the film is 1.54×10^{-4} cm. 5

d) What do you understand by antireflection coating ? Highlight their important applications. 10

Explain the formation of Newton's rings and show that the radii of dark rings are proportional to square roots of the natural numbers.

MODULE – II

3. a) Explain the principle of following :

i) Magnetostriction method for production of USW.

ii) Electrostatic focussing. 5

b) For barium titanate, Young's modulus is $81\times10^{10}\ \frac{\text{dyne}}{\text{cm}^2}$ and density is 5.51 g/cm^3. Determine the thickness of the crystal to produce ultrasonic waves of frequency 900 KHz. Further determine the ratio of new to old frequencies if the thickness of this crystal is changed to 2.8 mm. 5

c) Briefly explain acoustic diffraction method to determine velocity of ultrasonic waves. 5

d) Describe the principle and working of a GM counter. Highlight the importance of quenching in this counter. Mention the scientific application of a GM counter. How does this counter differs from a proportional counter and ionization chamber ? 10

4. a) Give an account of the properties of ultrasonic waves. How are USW used in flaw detection and depth sounding ? 5

b) Write short note on following :

i) Measurement of frequency of ac mains using CRO

ii) Quenching in a GM counter. 5

c) With the help of suitable diagram, explain the working of an electrostatic electron lens. 5

d) Explain direct and inverse piezoelectric effect. Draw circuit diagram of a piezoelectric oscillator and explain its working. Compare it with that of a magnetostriction oscillator in terms of performance. 10

SECTION – II

(Chemistry)

MODULE – III

5. a) Explain the construction and working of a glass electrode. How can glass electrode be used for pH determination of a solution ? 10

b) What is the working principle of a primary and secondary batteries ? 5

c) Draw a neat sketch of a calomel electrode and label its parts. Write the electrode reactions. 5

d) Calculate the emf of the cell consisting of zinc electodes, one immersed in a solution of 0.02 m and the other immersed in a solution of 0.001m.Solution of its ions at 25°C. Explain the working principle of the cell. 5

6. a) Explain the construction and working of : 10

i) $H_2 - O_2$ fuel cell

ii) $Li - MnO_2$ battery.

b) What are reference electrodes ? Give examples. 5

c) Derive the equation for expression of single electrode potentials. 5

d) Two copper rods are dipping in copper sulphate of concentrations 0.1M and 0.25 M. Formulate the cell. Calculate its emf and explain how the cell works. 5

MODULE – IV

7. a) How corrosion control can be achieved ? Mention various techniques adopted. **10**

   b) How do the physical state of the metal and purity affect the rate of corrosion ? **5**

   c) What is meant by metal finishing ? Give a brief account of electroplating of chromium. **5**

   d) Write short notes on the following :

      i) Overvoltage

      ii) Electroless plating. **5**

8. a) What are corrosion inhibitors ? Explain how anodic and cathodic inhibitors provide protection against corrosion ? **10**

   b) What is the difference between electroplating and electroless plating ? **5**

   c) What is differential aeration corrosion ? Illustrate it with an example. **5**

   d) Write short notes on :

      i) Polarisation

      ii) Decomposition potential. **5**