F.E. (Semester – 1) (Revised in 2007-08) Nov/Dec, 2016, Examination, APPLIED SCIENCE-I (Physics)

Duration: 3 Hours Max Marks: 100

Instructions: 1) Answer one question from each Module
2) Answer each section in separate answer book
3) Draw diagrams wherever required
4) Assume data if required

SECTION I
(PHYSICS)
Module - I

Q.1

a) Give an account of Phase change due to reflection of light from the surface of a denser medium. Obtain necessary formula. (5)

b) Derive an expression for conductivity of an intrinsic semiconductor in terms of mobility and carrier concentration. Hence write down the expression for resistivity of a n-type semiconductor. (5)

c) Newton's Rings are formed with reflected light of wavelength 589 nm. With the liquid between lens and the glass plate, the diameter of sixth bright ring is 0.3 cm. Determine the Refractive Index of liquid if the radius of the curvature of the lens is 102 cm. (5)

d) What is Continuity equation? Derive an expression for continuity equation for holes in a semiconductor. (10)

Q.2

a) Describe how the mobility of charge carriers is determined using Hall effect. (5)

b) A n-type semiconductor specimen of thickness 3 mm is arranged in a Hall experiment having transverse magnetic field of 0.5 Tesla and current density of 500 A/m^2. Calculate the value of Hall voltage developed if semiconductor specimen's donor density is $10^{21}/m^3$. (5)

c) What are Newton's rings? How can Newton's rings to be used to determine the wavelength of monochromatic light. (5)

d) Derive the condition of interference for bright and dark fringes due to reflected light from a thin film. Compare these results with those of a transmitted system. (10)

Module II

Q.3

a) Describe four methods of detection of ultrasonic waves. (5)

b) Briefly explain the medical and industrial applications of ultrasonic waves (2 each). (5)

c) With the help of a neat diagram explain electrostatic focusing. (5)

d) Explain direct and inverse piezoelectric effect. Draw a neat circuit diagram and describe Magnetostriction oscillator. (10)

Q.4

a) Write short notes on:- (5)
   i. Magnetic lens
   ii. Quenching in a Geiger Muller counter

b) A piezoelectric crystal of thickness 3 mm produces ultrasonic waves of frequency of 400 kHz. Calculate the thickness of this crystal to produce ultrasonic waves of frequency of 500 KHz. (5)

c) Explain how Geiger Muller counter differs from proportional counter and ionisation chamber. (5)

d) Draw the block diagram of C.R.O. and explain its working. How can you use C.R.O. to measure frequency of A.C. mains. (10)

SECTION II

(CHEMISTRY)

Module III

Q.5

a) A Galvanic cell is to be operated at 25°C is set up using the elements Ni and Mg. Write its cell representation and chemical reactions involved in the cell. Also find the EMF of the cell assuming that $Ni\,SO_4\,(0.01m)$ and $Mg\,SO_4(0.001m)$ were used as electrolytes (Given: $E°\,of\,Mi^{2+}$ = - 0.23v; $E°\,of\,Mg^{2+}$= - 2.37v) (6)

b) Define the terms: i) Electrode potential, ii) Standard electrode potential. Also explain their role in the Nernst equation. (5)

c) Describe the functioning of Fuel cell with solid oxide as its electrolyte (5)

d) Describe any five characteristics of a battery (5)

e) Draw a neat labelled diagram of Ag-AgCl electrode and write the relevant reaction involved in it (4)

Q.6

a) Illustrate the use of Glass electrode in the determination of PH of a sample (6)

b) Define the term 'Electrode Potential'. Determine the electrode potential of the following system: $Mg^{2+}(0.1m)/Mg\ at\ 25°C$. E° of Mg^{2+}= - 2.37v (5)

c) Describe the functioning of Fuel cell with Molten Carbonate as its electrocyte. (5)

d) Explain the working of Ni-MH battery. Also outline the role of Metal alloy in the battery system (5)

e) Define the terms, i) electrode potential, ii) Fuel cell, iii) Battery, iv) EMF (4)

Module IV

Q.7

a) Explain how a metallic structure can be protected from corrosion by using corrosion inhibitors and by using suitable design aspects. (6)

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

c) A metal rod covered with a tape for a long period of time upon inspection was found to have suffered corrosion. Incidentally the part of the metal which was covered with tape was found to have suffered corrosion. Explain the type of corrosion this metal has most likely undergone with necessary reactions (5)

d) Explain the process of PCB preparation using electro less plating (5)

e) Explain the process of tinning with the help of a neat labelled diagram (4)

Q.8

a) Explain any three methods by which corrosion can be controlled or avoided. (6)

b) Explain with the help of a neat labelled diagram Wet Chemical Mechanism of corrosion in a PH range of 2-3 of the medium. (5)

c) Outline the various surface preparation steps involved for a metal before plating operations. (5)

d) Draw the basic setup of Electrolysis bath and outline the role of the different components (5)

e) Explain how corrosion can be prevented by impressed current cathodic protection method (4)