



SEM 1 – 2 (RC 07-08)

F.E. (Semester – I) (Revised in 2007-08) Examination, May/June 2016
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** answer book.
3) Draw diagrams **wherever** required.
4) **Assume** additional data if required.

SECTION – I

(Physics)

Module – I

1. a) Derive the conditions of bright and dark interference fringes due to transmitted light from a parallel sided thin film. 5
b) What is the role of antireflection film ? Prove that the minimum thickness of antireflection film should be quarter wavelength thick. 5
c) The electron concentration in silicon decreases linearly from 10^{22} m^{-3} to 10^{20} m^{-3} over a distance of 0.2 cm. The cross-sectional area of the sample is 0.05 cm^2 . If $D_n = 25 \times 10^{-4} \text{ m}^2/\text{s}$, calculate the electron diffusion current. 5
d) What is continuity equation ? Derive expression for continuity equation for electrons and hole in a semiconductor. 10
2. a) Describe Newton's rings experiment to determine refractive index of liquid. Draw the experimental set up and obtain the expression for refractive index. 5
b) Derive the expression for fringewidth in a wedge shaped film. 5
c) Explain briefly generation and recombination of charge carriers in a semiconductor. Derive the expression for recombination of minority carriers within a semiconductor. 5
d) What is Hall effect ? Derive the expression for Hall voltage. 5
e) Newton's rings are obtained with reflected light of wavelength 6000 A.U. If the diameter of 10th dark ring is 0.6 cm, calculate the radius of curvature of the lens and hence find out the radius of 20th dark ring. 5



Module – II

3. a) Explain magnetostriction method to produce ultrasonic waves. Draw the necessary circuit diagram. 5
- b) Explain : 5
 - i) Echo sounding in marine application
 - ii) Flaw detection in metals.
- c) Distinguish between ionization chamber and GM counter. Explain why quenching is carried out in GM counter. 5
- d) Explain the construction and working of magnetic lens. 5
- e) Describe any two methods for detection of ultrasonic waves. 5
4. a) Discuss acoustic diffraction method to find velocity of ultrasonic waves in liquid. 5
- b) Explain the construction and working of electrostatic lens. 5
- c) Explain : 5
 - i) What is cavitation.
 - ii) What is electron gun.
- d) Explain the method of measuring voltage and frequency of ac signal on CRO. Draw neat labelled diagrams of CRT and CRO. 10

SECTION – II

Module – III

5. a) Outline the construction of calomel electrode and illustrate how it can be used to find pH. 6
- b) With the help of a neat labelled diagram explain, the construction of Ni-MH battery. 5
- c) Explain the functioning of polymer based electrolyte fuel cell. 5
- d) Calculate the EMF of the following : 5
 - i) The cell formed by dipping Mg rod in 0.01 M Mg^{2+} solution and Ni rod in 0.1 M Ni^{2+} solution ($E^\circ \text{Mg} = -2.73 \text{ V}$ and $E^\circ \text{Ni} = -0.25 \text{ V}$).
 - ii) Cu electrodes dipped in Cu^{2+} solution of 0.1M and 0.01M concentration.
- e) Define the term Electrode potential and Standard electrode potential. 4



6. a) Illustrate the use of ion selective electrode in analysis of ions in a given sample. 6
- b) With the help of a neat labelled diagram explain the working of fuel cell with Hydrogen as fuel, Oxygen as oxidant and suitable electrolyte. 5
- c) With the help of a neat labelled diagram explain the construction and working of Zn-air battery. 5
- d) Derive the expression for determination of single electrode potential. 5
- e) Determine the electrode potential for the following system Al/Al^{3+} (0.01M) (Given $E^\circ Al = -1.66 V$). 4

Module – IV

7. a) Define the term corrosion. Outline the mechanism involved in dry or chemical process of corrosion. 6
- b) Explain galvanic and concentration cell corrosion by taking suitable examples. 5
- c) Explain the basic set up of an electroplating bath for the purpose of plating an object with Gold. 5
- d) Explain the hot dipping process of coating a metallic object with tin. 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) With the help of a suitable example explain the electrochemical theory of corrosion. 6
- b) An article upon cleaning after a period of over a year, was found to have developed tiny pores of discoloration on its surface. Explain the type of corrosion the article has suffered with suitable example and relevant reactions. 5
- c) Outline the various constituents of electroless plating bath with suitable examples. 5
- d) Explain the process of galvanization with the help of a neat labelled diagram. 5
- e) Define the term 'Anodization' of metal by taking a suitable example. 4