



SEM 1-2 (RC 07-08)

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

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 data if **required**.

SECTION – I

(Physics)

MODULE – I

1. a) Write short note on antireflection films. Briefly explain amplitude and phase requirement in such films. 5
b) Briefly discuss the concept of carrier diffusion in a semiconductor. Obtain an expression for total current density due to drifting and diffusion of charge carriers. 5
c) Light of wavelength 6000 \AA is used to observe Newton's rings with reflected light. The diameter of 15th dark ring is recorded as 0.55 cm. Determine the radius of 40th dark ring and the radius of curvature of the lens used. 5
d) Briefly explain generation and recombination of charge carriers in a semiconductor. Prove that the excess concentration decreases with time exponentially, after the photo injection of carriers is stopped. 10
2. a) Give an account of physical origin of Hall effect. Explain application of Hall effect in identifying the type of semiconductor. 5
b) The mobilities of electrons and holes in a silicon single crystal at 27°C are 0.17 and $0.025 \text{ m}^2/\text{Vs}$ respectively. Find the diffusion coefficients of electrons and holes in the crystal at 27°C . 5

P.T.O.



- c) Why is extended source of light is preferred to a point source while studying interference in thin films ? Explain briefly. 5
- d) Discuss the appearance of colors in thin film illuminated by the extended source of light. How will you account for the phase change due to reflection of light from the surface of the denser medium ? Show that interference patterns of reflected and transmitted monochromatic sources of light in a thin film are complementary. 10

MODULE – II

3. a) Describe medical and industrial applications of ultrasonic waves 2 (each). 5
- b) Write a short note on magnetostatic focusing. 5
- c) Describe piezoelectric method to produce ultrasonic waves. 5
- d) Write short notes on the following : 10
- i) Cavitation
 - ii) Ionisation chamber
 - iii) Electron gun
 - iv) Echo sounding on the marine application.
4. a) Explain in brief three methods for detection of ultrasonic waves. 5
- b) Calculate the natural frequency of 40 mm length of a pure iron rod. Given the density of pure iron is $7.25 \times 10^3 \text{ kg/m}^3$ and its Young's modulus is $115 \times 10^9 \text{ N/m}^2$. Can you use it in magnetostriction oscillator to produce ultrasonic waves ? 5
- c) Briefly explain the working of ionisation chamber and proportional counter. 5
- d) Explain with the help of a neat diagram the construction and the working of C.R.O. and also describe the various parts of Cathode ray tube. 10



SECTION – II

(Chemistry)

MODULE – III

5. a) Construct a Galvanic and concentration cell by taking suitable examples of electrodes and electrolyte concentration. Write its representation, reactions involved and calculate its EMF. 6
- b) Explain the working of a 'Polymer Electrolyte' fuel cell. 5
- c) Derive Nernst equation and explain its importance. 5
- d) Explain the construction of Calomel electrode. Write its representation and reaction involved. 5
- e) Define the terms :
- i) Electrode potential
 - ii) Fuel cell
 - iii) Battery
 - iv) EMF. 4
6. a) Illustrate the use of Ion-selective electrode in the analysis of H^+ ions in a given sample. 6
- b) The following cell $Zn/Zn^{2+}(0.01M) // Zn^{2+}(0.1M)/Zn$ was used in order to obtain electrical energy. State the principle behind working of this cell and calculate its EMF. 5
- c) Outline the characteristics of the foll. fuel cells. 5
- a) Molten carbonate fuel cell
 - b) Solid oxide fuel cell.
- d) With the help of a neat labelled diagram, explain the construction of Zn-air battery. 5
- e) Briefly explain any two characteristics of battery. 4



MODULE – IV

7. a) Outline the mechanism involved in an electrochemical process of corrosion when the metal is in contact in a medium of neutral pH. 6
- b) Explain the basic set up of an electroplating bath with the help of a suitable example. 5
- c) Explain the type of corrosion a tank made up of iron which is used for storing water most likely to undergo, Give relevant reactions. 5
- d) Outline the various constituents of an electroless plating bath. 5
- e) Briefly explain various steps involved in surface preparation of metals before plating process. 4
8. a) Explain Galvanic and stress corrosion by giving suitable examples along with necessary diagrams and reactions involved. 6
- b) Explain the process of PCB preparation using electroless plating. 5
- c) Describe the oxidation corrosion process in dry atmosphere by giving suitable example. 5
- d) With the help of a neat labelled diagram explain the wet electrochemical method of corrosion in acidic environment. 5
- e) What is metal finishings ? Give its technological importance. 4