



SEM 1 – 2 (RC 07 – 08)

F.E. (Semester – I) (Revised in 2007-08) Examination, May/June 2017
APPLIED SCIENCE – I
Physics and Chemistry

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

1. a) With the help of experimental arrangement, explain the method to determine R. I. of transparent liquid. Obtain necessary formula. 5
b) Briefly explain physical origin of Hall effect. Derive an expression for Hall voltage developed. 5
c) Newton's rings are obtained with reflected light of wavelength 5000 \AA . If the diameter of 10^{th} dark ring is 0.5 cm , calculate the radius of curvature of the lens and hence find out the radius of 50^{th} dark ring. 5
d) What is continuity equation ? Derive an expression for continuity equation for holes in a semiconductor. 10
2. a) Derive an expression for conductivity of an intrinsic semiconductor in terms of carrier mobility and carrier density. 5
b) The Hall coefficient of a doped silicon is found to be $3.66 \times 10^{-4} \text{ m}^3/\text{c}$. The resistivity of sample is $8.93 \times 10^{-3} \Omega\text{-m}$. Determine the mobility and density of charge carriers. 5
c) What do you understand by antireflection coating ? Deduce an expression for minimum thickness of antireflection coating. 5
d) Explain the formation of interference fringes in a wedge shaped thin film of air enclosed between two plane glass plates. Derive an expression for fringe width in a wedge shaped film in terms of angle of wedge and wavelength of monochromatic light. 10

P.T.O.



Module – II

3. a) Briefly explain acoustic diffraction method to determine the velocity of ultrasonic waves. 5
- b) Write short notes on : 5
- i) Electrostatic focussing
- ii) Quenching in a GM counter.
- c) Calculate the frequency of the fundamental note emitted by piezoelectric crystal. Use the following data : 5
- Vibrating length = 3 mm
- Young's modulus = $8 \times 10^{10} \text{ N/m}^2$, $\rho = 2.5 \times \text{gm/cm}^3$.
- d) Describe four methods of detection of ultrasonic waves. Explain the term direct and inverse piezoelectric method. Explain piezoelectric method of producing ultrasonic waves. How is it superior than magnetostriction method ? 10
4. a) Write short note on the following : 5
- i) Electron gun
- ii) Proportional counter.
- b) With the help of a neat diagram explain magnetostatic focusing. 5
- c) Explain four properties of ultrasonic waves. Give an account of medical and industrial applications of ultrasonic waves. 5
- d) Describe the difference between ionisation chamber, proportional counter and Geiger Muller counter. Briefly explain the construction and working of GM counter. How is quenching achieved in this counter ? 10

SECTION – II

(Chemistry)

Module – III

5. a) Explain the working of Mi-MH battery system with relevant reactions. 6
- b) Outline the construction of a reference electrode and illustrate its use for pH determination. 5
- c) The following cell $\text{Al} \mid \text{Al}^{3+} (0.1 \text{ M}) \parallel \text{Al}^{3+} (0.01 \text{ M}) \mid \text{Al}$ was used in order to obtain electrical energy. State the principle behind its working and calculate the EMF. 5



- d) Explain the construction and working of hydrogen-oxygen fuel cell system. 5
- e) Explain the working of Zn-air battery. 4
6. a) Define the term 'Electrode Potential'. Determine the electrode potential of the following system :
 $\text{Cu}^{2+} (0.1 \text{ M}) \mid \text{Cu}$ at 25°C . E° of $\text{Cu}^{2+} = 0.34\text{V}$. 6
- b) Outline the construction of glass electrode and illustrate its use in pH determination. 5
- c) Outline the characteristics of the following fuel cells : 5
- a) Polymer electrolyte fuel cell
- b) Phosphoric acid fuel cell.
- d) Explain the following characteristics with reference to a battery : 5
- i) Capacity
- ii) Voltage.
- e) Explain the working of Li-MnO_2 battery. 4

Module – IV

7. a) Explain how corrosion can be controlled by sacrificial anodic protection and metal coatings. 6
- b) Explain pitting and galvanic type of corrosion by taking suitable examples. 5
- c) Explain the process of electroplating an article with chromium. 5
- d) Outline the factors affecting rate of corrosion. 5
- e) Briefly explain various steps involved in surface preparation of metals before plating process. 4
8. a) Explain water-line 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) Explain how nature of oxide layer affects the further rate of corrosion. 5
- d) Outline the various types of mechanism involved in dry chemical corrosion. 5
- e) What is metal finishing ? Give its technological importance. 4
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