



SEM 1 – 2 (RC 07-08)

**F.E. (Semester – I) (Revised in 2007-08) Examination, May/June 2015**  
**APPLIED SCIENCE – I (Physics and Chemistry)**

Duration : 3 Hours

Total Marks : 100

- Instructions :**
- 1) Answer one question from each Module.
  - 2) Answer Physics and Chemistry Section in Separate answer sheet.
  - 3) Draw diagrams wherever required.
  - 4) Assume additional data, if required.

**SECTION – I**

**(Physics)**

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**Module – I**

1. a) Derive an expression for optical path difference for reflected rays in a parallel sided thin film. Hence show that interference patterns of reflected and transmitted rays are complimentary to each other. 5  
b) Newtons rings are seen with reflected light of wavelength  $6000 \text{ A}^\circ$ . Determine the radius of  $30^{\text{th}}$  dark ring and radius of curvature of the lens used if the diameter of  $15^{\text{th}}$  dark ring is measured as 5.5 m. 5  
c) Derive an expression for fringe width of interference fringes formed in a wedge shaped thin film. 5  
d) What is continuity equation ? Derive equation of continuity for excess carriers in a semiconductor. 10
2. a) Describe how the mobility of charge carriers determined using hall effect ? 5  
b) Write a short note on non-reflecting films. Briefly explain amplitude and phase requirement in such films. 5  
c) The resistivity of a pure semiconductor strip of length 5 cm, thickness 2 mm and breadth 5 mm at room temperature is found to be  $2000 \Omega \cdot \text{m}$ . Calculate the number of electrons in the conduction band if mobility of electrons and holes are  $0.14 \text{ m}^2/\text{v.s.}$  and  $0.05 \text{ m}^2/\text{v.s.}$  respectively. 5  
d) How are colours exhibited by thin films ? Briefly explain necessity of an extended source to observe interference pattern in thin parallel films.  
Show that the interference patterns of reflected and transmitted monochromatic sources of light in a thin film are complementary. 10

**Module – II**

3. a) Explain the principle of following : 5
- Piezoelectric method for production of ultrasonics
  - Cavitation and its application.
- b) Briefly explain the working of an electrostatic electron lens. 5
- c) Give an account of the properties of ultrasonic waves (any two). How are ultrasonics used in flow detection and depth sounding ? 5
- d) How does a GM Counter differ from an ionisation chamber and proportional counter ? Briefly discuss the principle and working of a GM Counter. Also highlight an importance of quenching in this counter. 10
4. a) Write short note on acoustic diffraction method for the detection of ultrasonic waves. How can this method be used for determining velocity of USW ? 5
- b) Describe principle and working of ionisation chamber. State its difference from a GM Counter. 5
- c) Draw the block diagram of a CRO and briefly explain its application to measure amplitude of dc voltage. 5
- d) State three properties of ultrasonic waves. Give an account of magnetostriction method for production of USW. Compare this method with a piezoelectric oscillator. 10

**SECTION – II****(Chemistry)****Module – III**

5. a) Calculate the EMF of the following : 7
- The cell formed by dipping  $Z_n$  rod in 0.01 M  $Z_n^{2+}$  solution and Ni rod in 0.1 M  $Ni^{2+}$  solution. (Given  $E^\circ$  of  $Z_n = -0.76$  V and  $E^\circ$  of Ni = 0.25 V).
  - $Ag/Ag^+(0.01\text{ M}) \parallel Ag^+(0.1\text{ M}) | Ag$ .
- b) Define the terms : 6
- Electrode potential.
  - Standard electrode potential and explain their role in Nernst Equation.
- c) Define the terms Battery and Fuel cell and outline its basic set up. 6
- d) With the help of a neat diagram explain the constitution of Ion selective electrode and write its cell representation. 6



6. a) Outline the construction of a reference electrode and illustrate the use of the same in the determination of pH. 7
- b) Explain how the following characteristics affect a battery system : 6
- a) Voltage
  - b) Capacity
  - c) Operating Temperature.
- c) With the help of a neat labeled diagram explain the construction and working of Ni-MH battery. 6
- d) Determine the electrode potential for the following system Al/Al<sup>3+</sup> (0.01 M) at 25°C (Given E°<sub>Al</sub> = -1.66 V). 6

#### Module – IV

7. a) Describe with the help of a suitable example the electrochemical mechanism of corrosion in a pH range of 6.8 – 7.2. 7
- b) Explain the role of the following in an electroplating process : 6
- a) Throwing power
  - b) Concentration of electrolyte
  - c) Preparation of surface.
- c) Describe the use of corrosion inhibitors and sacrificial anodic protection process towards corrosion control. 6
- d) Describe a method for preparing conducting surface on a plastic body using electroless plating method. 6
8. a) Describe with the help of a suitable example the mechanism of corrosion occurring in dry atmosphere due to presence of oxygen. 7
- b) Explain how the nature of metal and environment affect the rate of corrosion. 6
- c) Outline the various constituents of an electroless plating bath with the help of a specific example. 6
- d) Describe the process of electroplating of an object using Gold metal coating. 6