Total No. of Printed Pages:02

F.E. Semester-I (Revised Course 2007-2008) EXAMINATION MAY/JUNE 2019
Applied Science-I (Physics & Chemistry)

[**Duration : Three Hours**]   [**Total Marks : 100**]

Instructions: 1) Answer **one** question from **each** Module.
                         2) Answer the **two** Sections in separate answer books.
                         3) Assume additional data, **if required.**
                         4) Draw diagrams **wherever** required.

MODULE I

Q.1   a) Briefly explain the physical origin of Hall Effect and hence derive an expression for Hall coefficient.   05

      b) Newton's rings are formed with reflected light of wavelength 589nm. With a liquid between lens and glass plate, the diameter of the sixth bright ring is 0.3cm. Determine R.I. of the liquid if radius of curvature of the lens is 102cm.   05

      c) In case of antireflection coating, show that the minimum thickness should be quarter wavelength of incident light   05

      d) What is continuity equation? Derive equation of continuity for excess carriers in a semiconductor.   10

Q.2   a) Discuss the phase change due to reflection of light from the surface of a denser medium. Obtain necessary formula.   05

      b) A n- type semiconductor specimen of thickness 3 mm is arranged in a Hall experiment having transverse magnetic field of 0.5 T and current density 500 A/m^2.calculate the value of Hall voltage developed if semiconductor specimen's donor density is $10^{21}/m^3$.   05

      c) Explain the process of diffusion in semiconductor and derive an expression for the diffusion coefficients for holes and electrons by Einstein's theory of diffusion.   05

      d) Explain :   10
          i)   Phase change at reflection
          ii)   Meaning of optical path and geometrical path
          iii)   Application of interference in checking the flatness of plane surface.

MODULE II

Q.3   a) Mention five properties of ultrasonic waves. State the application of ultrasonic wave using the principle of echo sounding.   05

      b) Draw the block diagram of CRO. How is it used to find the frequency of AC mains?   05

      c) Distinguish between ionization chamber and GM counter. Explain why quenching is carried out in GM counter.   05

      d) Explain direct and inverse piezoelectric effect. Draw circuit diagram of a piezoelectric oscillator and explain its working. Compare it with that of a magnetostriction oscillator in terms of performance.   10

1

Q.4   a) Ultrasonic waves are to be produced by a magnetostriction oscillator using iron or Nickel rod   **05**
           of the same length 8.5cm.
           Which one will be suitable for the production of USW? Justify your answer.
           Given density of iron = $7.8 \times 10^3 \text{kg/m}^3$
           Density of Nickel = $8.9 \times 10^3 \text{kg/m}^3$
           Young's modulus for iron == $11.5 \times 10^{10}\ N/m^2$
                    Young's modulus for Nickel = $20.7 \times 10^{10}\ N/m^2$

       b) Describe construction and working of ionization chamber.   **05**
       c) Briefly explain the medical and industrial applications of ultrasonic. (2 each)   **05**
       d) Explain why sawtooth voltage is required to display the waveform of any signal on a CRO   **10**
           screen.
                    Explain how the blanking of retrace path is achieved. A sine wave voltage of frequency
           150Hz is fed to the vertical input and simultaneously a sawtooth voltage of frequency 100Hz is
           fed to the horizontal input of a CRO. Explain with a neat diagram what display you would get
           on the screen?

MODULE III

Q.5   a) Outline the construction of Hydrogen Electrode and illustrate how it can be used to find the   **08**
           pH.
       b) With the help of a neat labeled diagram explain the construction and working of Zn-Air   **06**
           battery.
       c) Define the terms Battery and Fuel Cell and outline its basic setup.   **06**
       d) Determine the Electrode potential for the following system Mg/Mg^{2+} (0.01M). (Data Given   **05**
           E^0_{Mg}=-2.37 V)

Q.6   a) Outline the construction of a Calomel electrode and illustrate how it can be used to find the   **08**
           pH.
       b) Explain how the following characteristics affect a battery system a. Voltage b. Capacity c.   **06**
           Operating Temperature
       c) With the help of a neat labeled diagram explain the construction and working of Alkaline Fuel   **06**
           Cell.
       d) Determine the cell potential for the following system Ag/Ag^+(0.01M) // Ag^+(0.1M)/Ag.   **05**
           At 25°C (Data Given E^0_{Ag}=+0.80V)

MODULE IV

Q.7   a) Explain any four methods by which corrosion can be controlled or avoided.   **08**
       b) Explain the Dry or Chemical mechanism of corrosion.   **06**
       c) Explain the basic setup of an Electroplating bath with the help of suitable example.   **06**
       d) Explain the process of PCB preparation using electroless method.   **05**

Q.8   a) Outline the various factors due to nature of metal which affects the corrosion rate.   **08**
       b) Explain the process of Galvanizing with the help of a neat labeled diagram.   **06**
       c) Outline the various constituents of a Electroless plating bath.   **06**
       d) Describe the process of Electroplating of chromium.   **05**