SEM 2 – 2 (RC 07 – 08)

F.E. (Semester – II) (RC) Examination, November/December 2015
APPLIED SCIENCE – II
(Physics & Chemistry)

Duration : 3 Hours | Total Marks : 100

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

Physical Constants :

Planck's constant = 6.626×10^{-34} J-s	Electron charge = 1.6×10^{-19} C
Boltzmann constant = 1.38×10^{-23} J/k	Electron mass = 9.1×10^{-31} kg
Rydberg constant = 1.097×10^{7} /m	Velocity of light = 3×10^{8} m/s

SECTION – I

(Physics)

Module – I

1. a) Explain the term acceptance cone in optical Fibres. Mention three advantages of optical fibre communication over conventional communication system. **5**

   b) An optical fibre has N.A. of 0.15 and a cladding refractive index of 1.55. Determine the angle of acceptance of the fibre in water whose refractive index is 1.33. **5**

   c) Discuss Einstein's theory of Stimulated Emission. **5**

   d) Explain the process of stimulated emission. Draw a neat diagram to represent the component of a Ruby Laser. Explain the operation. **10**

P.T.O.

2. a) What is meant by modes of propagation ? Write down expressions for number of modes in SI and GRIN fibres. 5

   b) Derive expression for numerical aperture of an optical fibre. Give its significance. 5

   c) A Laser system emits light of wavelength 6925A° and 6941A° during transitions taking place at ground state from upper and lower energy levels states. Determine the ratio of populations of these energy levels also calculate the energy values of these energy levels in eV. 5

   d) What is lasing action ? Describe working of a gas laser with the help of energy level diagram. 10

Module – II

3. a) State and explain Mosley's Law. Also mention its significance. 5

   b) Calculate the de Broglie's wavelength associated with an electron moving with a kinetic energy of 10 eV. 5

   c) Explain Type -I and Type - II Superconductors. 5

   d) Derive Bragg's equation for reflection of X-rays by crystal plane. Describe Bragg's X-ray spectrometer to verify Bragg's law. 10

4. a) What is characteristics X-ray spectrum. Explain their origin. 5

   b) If the potential difference applied across the X-ray tube is 12KV and the current through is 2mA. Calculate :

      1) The number of electrons striking the target per sec.

      2) The speed which they strike

      3) The shortest wavelength emitted. 5

   c) Explain Meissner effect. Give two applications of superconductivity. 5

   d) What is Compton Effect ? Derive an expression for Compton shift. Is it possible to observe Compton effect with white light ? Justify your answer. 10

SECTION – II

(Chemistry)

Answer **one** question from **each** Module.

Module – III

5. a) A polymer was prepared by using Methyl methacrylate monomer.
   i) Write the structure of the resultant polymer. 1
   ii) State the type of polymerization it undergoes. 1
   iii) Explain briefly the method of bulk polymerization. 3
   iv) State any two properties of the polymer. 1
   b) Explain the Bergius process for synthesis of pertrol. 5
   c) Explain the term 'Elastomer'. Outline the synthesis and applications of any one Elastomer. 5
   d) Explain the method for production of solar grade silicon. 5
   e) Define the following terms :
      a) Fuel
      b) Calorific value
      c) Glass transition temperature
      d) Adhesive. 4

6. a) What is reforming ? Explain with examples any 3 reforming reactions. How does reforming increase octane number. 6
   b) Explain Fischer Tropsch process for synthesis of petrol. 5
   c) Explain the bulk method of polymerization. 5
   d) Outline the synthesis, properties and applications of phenol for maldehyde polymer. 5
   e) Define the following terms :
      a) GCV
      b) NCV
      c) Elastomer
      d) Conducting polymer. 4

Module – IV

7. a) A sample of water is found to contain 40.5 mg/L $Ca(HCO_3)_2$, 46.5 mg/L $Mg(HCO_3)_2$, 27.6 mg/L $MgSO_4$, 32.1 mg/L $CaSO_4$ and 22.45 mg/L $CaCl_2$. Calculate total hardness of water. **6**

   (Given At.wt. of Ca = 40, Mg = 24, S = 32, O = 16, H = 1, C= 12, Cl = 35.5)

   b) What is a conductometric titration. Give one application. Explain the principle involved in it. **5**

   c) Explain the process of Flash Evaporation for treating saline water with relevant diagram. **5**

   d) What is a liquid crystal ? Give its classification with examples. **5**

   e) Define BOD and COD of sewage. What are its significance ? **4**

8. a) Explain the various processes involved in sewage water treatment. **6**

   b) Explain the methods used for determination of hardness and alkalinity of water. **5**

   c) With the help of a neat diagram explain the nematic and smectic liquid crystal. **5**

   d) Explain the principles involved in electrodialysis and reverse Osmosis method of water purification. **5**

   e) Briefly explain the principle and construction of potentiometer. **4**