03-06-15 (M)

SEM 2 – 2 (RC07 – 08)

F.E. (Semester – II) (Revised in 2007-08 Course)
Examination, May/June 2015
APPLIED SCIENCE – II (Physics and 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) What is the basic principle of fibre optics ? Explain the classification of optical fibres based on modes of propagation. **5**

   b) Calculate NA, Acceptance angle and Critical angle of a fibre having core R.I. 1.50 and Cladding R.I. 1.488. **5**

   c) Discuss various properties of a Laser beam and its advantages over conventional light source. **5**

   d) Explain the terms

      i) Stimulated emission and

      ii) Resonating cavity. With the help of neat diagram, explain construction and working of a Ruby Laser. **10**

P.T.O.

2. a) Mention the characteristic properties of laser. Explain in brief any two industrial application of Laser. 5

   b) The relative population of two energy states in a Laser that emits wavelength 6200A° is 2.359×10^{-34}. Find the temperature at which the Laser emits light. 5

   c) Explain three differences between a Step-Index fibre and Graded Index fibre. 5

   d) Describe in brief

      1) Construction and viewing of Hologram

      2) Optical fibre communication. 10

Module – II

3. a) Explain in brief

      i) Meissner effect

      ii) Silsbee effect. 5

   b) A photon of energy 10keV is made incident on an electron and gets scattered through an angle of 90°. Find energy of scattered photon. 5

   c) With a neat diagram describe the production of X-rays by Coolidge tube. 5

   d) Explain de Broglie's concept of matter waves. Give account of the experiment to show the wave like character of a beam of electrons. 10

4. a) State Moseley's Law. Explain origin of characteristic X-ray spectra. 5

   b) What voltage must be applied to an electron source to produce electron having de Broglie's wavelength of 0.4A°. What will be K.E. of the electron moving under this potential ? 5

   c) Discuss Type – II Superconductor. What is its advantage over Type – I Superconductor ? 5

   d) What is Compton Effect ? Derive an expression for Compton shift. Discuss various cases with regard to angle of scattering. 10

SECTION – II

(Chemistry)

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 process of fluidized bed catalytic cracking process with the help of a neat labeled diagram. 5
   c) Explain the terms involved in grading of gasoline and diesel fuels. 5
   d) Outline the physical and chemical properties of silicon in relation with photovoltaics. 5
   e) Define the following terms :
      a) Fuel
      b) Calorific value
      c) Glass transition temperature
      d) Polymer. 4

6. a) Explain an experimental method using a heat labeled diagram for determination of GCV of a fuel. 6
   b) On burning 0.93 gm of a solid fuel in a bomb calorimeter, the temperature of 2500 gm of water increased from 25.5°C to 28.0°C. Water equivalent of calorimeter and latent heat of steam are 325 g and 587 cal/g respectively. If the fuel contains 6% hydrogen calculate its gross and net calorific value. 5
   c) Name and state the function of the ingredients used to compound a polymer to yield a plastic material. 5
   d) Explain the method to obtain solar grade Silicon. 5

e) Define the following terms :

a) Elastomer

b) Water equivalent of calorimeter

c) Degree of polymerization

d) Adhesives. 4

Module – IV

7. a) A sample of water was 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 CaSO4 and 22.45 mg/L $CaCl_2$. Calculate the total hardness of water (Given At. wt of Ca = 40, Mg = 24, S = 32, O = 16, C = 12, Cl = 35.5, H = 1). 6

b) With the help of neat diagram explain the behaviour of cholesteric liquid crystal with respect to change in temperature. 5

c) With the help of neat labeled diagram explain the working of potentiometer. 5

d) Outline the principle involved in the following :

a) Flash Evaporation

b) Reverse Osmosis. 5

e) Draw the Micelle and Lamellar phases of lyotropic liquid crystals. 4

8. a) Distinguish between thermotropic and lyotropic liquid crystals with examples. 6

b) With the help of a neat labelled diagram explain 'Electrodialysis'. 5

c) Define BOD. How is it determined ? 5

d) Draw the block diagram of photoelectric colorimeter. 5

e) Give an account of Nematic liquid crystals. 4