SEM – 2-2 (RC 07-08)

F.E. (Semester – II) (Revised in 2007-08) Examination, May/June 2016
APPLIED SCIENCE – II (PHYSICS AND CHEMISTRY)

Duration : 3 Hours | Total Marks : 100

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

Physical Constants :

Planck's constant = 6.626×10^{-34} J-s *Boltzmann's constant = 1.38×10^{-23} J/K.*

Electron charge = 1.6×10^{-19} C *Rydberg constant = 1.097×10^{7}/m.*

Electron mass = 9.1×10^{-31} Kg *Velocity of light = 3×10^{8} m/s.*

SECTION – I (**Physics**)
MODULE – I

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

1. a) What are step-index and graded index optical fibres ? Draw their R.I. profile. **5**
   b) Discuss Einstein's theory of stimulated emission. **5**
   c) Find the relative population of two energy states in a laser that produces a light beam of wavelength 6943 Å at 400 K. **5**
   d) Describe construction and working of a solid state laser. Draw the necessary diagrams. In what way it differs from He-Ne laser. (give any two differences). **10**

2. a) Discuss various properties of laser. **5**
   b) Give the advantages and disadvantages of fibre optics communication over ordinary cable communication. **5**
   c) An optical fibre has core R.I 1.52 and $\Delta = 0.007$. Find
      i) Cladding R.I.
      ii) Critical angle
      iii) Acceptance angle
      iv) Numerical aperture. **5**

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d) Explain the following terms :
   i) Acceptance angle
   ii) Numerical aperture
   iii) Stimulated emission
   iv) Population inversion
   v) Pumping. 10

MODULE – II

3. a) Distinguish between Type-I and Type-II superconductor. 5

   b) Distinguish between X-rays and γ-rays. 5

   c) While comparing the wavelength of two monochromatic X-rays lines, it is found that line A gives first order Bragg's reflection maximum at a glancing angle of 20° to the smooth surface of a crystal. Line B of known wavelength 1 Å gives a third order reflection maximum at a glancing angle of 50° with the same face of the same crystal. Find the wavelength of the line A. 5

   d) Describe the production of X-rays by Coolidge tube. How intensity and quality of X-rays are controlled ? 10

4. a) State and explain Mosley's law. Mention its significance. 5

   b) Discuss in brief the BCS theory of super conductivity. 5

   c) Critical temperature of superconductor when no magnetic field is present is 10 K. Find the temperature at which the critical field becomes half of its value at 0 K. 5

   d) Derive an expression for wavelength associated with electron moving under a potential of V volts. Describe an experiment to show the wave-like character of a beam of electrons. 10

SECTION – II (**Chemistry**)

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

MODULE – III

5. a) Explain the term Cracking of Hydrocarbon (HC) and describe any one process for cracking of HC. 6

   b) State the various ingredients involved in compounding of polymers to yield a plastic material, also state their role and give one example each. 5

c) Explain the process of Fractional distillation with the help of a neat labelled diagram. 5

d) Define the term 'Elastomer'. Outline the synthesis, properties and application of any one elastomer. 5

e) Define the following terms :

i) Fuel

ii) Calorific value

iii) Glass Transition Temperature

iv) Polymer. 4

6. a) Define the terms G.C.V and N.C.V and describe briefly the method for determining the same. 6

b) Explain the Bulk and Solution method of polymerization. 5

c) Explain the different stages involved in the refining of crude oil with relevant diagrams. 5

d) Define the term 'Adhesive'. Outline the synthesis and applications of any one adhesive. 5

e) Outline the production of metallurgical and solar grade silicon. 4

MODULE – IV

7. a) A water sample was analyzed for

i) DO

ii) Hardness

The test analysis as per standard protocols gave the following data :

i) 100 ml of the water sample upon titration with 0.01 M $Na_2S_2O_3$ required 2.0 ml of the titrant.

ii) The sample showed the presence of $CaCO_3$ (100 ppm) and $MgCl_2$ (200 ppm). Find the DO (in ppm) and Hardness (in ppm $CaCO_3$ eq.) (data given At. Wt. of Ca = 40; C = 12; O = 16; Mg = 24; Cl = 35.5) 6

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

c) With the help of neat diagram, illustrate the transition of a material from solid to smectic, nematic and liquid phases in the order of their energy levels. 5

d) Discuss the structural features of amphiphile in a Lyotropic LC phase. Draw any two Lyotropic LC phases. 5

e) Briefly explain the working of potentiometer. 4

8. a) Discuss the experimental methods for determination of Hardness, Alkalinity and dissolved oxygen content in water. 6

b) With the help of neat diagram, explain the behavior of Cholesteric Liquid Crystal with respect to change in temperature and state one application associated with this phenomenon. 5

c) Explain the process of chlorination with respect to break point chlorination with relevant diagram in the disinfection of water. 5

d) Discuss the Liquid Crystalline properties associated with PAA homologous series. 5

e) Briefly explain the principle and working of Colorimeter. 4