SEM 2 – 2 (RC 07-08)

F.E. (Semester – II) (Revised in 2007-08) Examination, May/June 2017
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

Applied Science – II (Physics)

Module – I

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

1. a) Discuss step index and graded index optical fibre.   5

   b) Discuss Einstein's theory of stimulated emission.   5

   c) N.A. of optical fibre is 0.488. If core index is 1.52 find cladding index. If fibre is immersed in water (RI 1.33) what will be the acceptance angle ?   5

   d) Describe construction and working of He-Ne Laser with neat diagrams. Discuss any two applications of laser in industry.   10

2. a) Derive the expression for numerical aperture of a SI fibre.   5

   b) Discuss various properties of Laser. In what way Laser differs from ordinary monochromatic light ?   5

   c) Find the relative population of two energy states in a laser that produces a light beam of wavelength 6000 Å at 300 k.   5

P.T.O.

d) i) What are advantages and disadvantages of fibre optics communication over the conventional one ? **10**

 ii) What is mode of propagation ? Discuss the types of optical fibres with regard to modes of propagation.

Module – II

3. a) State and explain Mosley's Law. Give its significance. **5**

 b) Explain the following terms in superconductors
  i) Effect of external field
  ii) Silsbee effect. **5**

 c) A photon of energy 1.6×10^{-13} J is scattered by a free electron through 90°. Calculate energy of electron and photon after interaction. **5**

 d) Explain deBroglie concept of matter waves, Describe an experiment to establish wavelike character of a beam of electrons. **10**

4. a) Briefly explain the phenomenon of superconductivity and hence distinguish between type – I and type – II Superconductors. **5**

 b) What are characteristic X-rays ? Explain their origin. **5**

 c) K_α line of wavelength 1.55 Å undergoes reflection from a crystal with

  interplanar spacing 4.25 Å. **5**

  Calculate :
   i) the smallest glancing angle
   ii) the highest order of reflection that can be observed with this radiation.

 d) Photons collide elastically with loosely bound electrons of a graphite sample. Show that the wavelength shift of scattered photons depends only on the scattering angle and not on the wavelength of incident radiations. **10**

SECTION – II

Applied Science – II (Chemistry)

Module – III

5. a) Explain any two methods for obtaining crude oil by synthetic methods. **8**

 b) Outline the mechanism of free radical polymerization by using suitable example of initiator and monomer. **6**

c) With the help of neat labeled diagram explain an experimental method for determination of GCV of a fuel. **6**

d) Define the following terms : **5**
   i) Fuel
   ii) Calorific value
   iii) Class transition temperature
   iv) Polymer
   v) Degree of Polymerization.

6. a) Explain the method of polymerization used to prepare an elastomer. Name and write the structures of any two elastomers along with their uses and properties. **8**

b) With the help of neat labeled diagram explain the synthesis of petroleum by using the Bergius process. **6**

c) Explain the process of electrical conduction in polyacetylene polymer. **6**

d) A fuel weighing 0.80 g was tested in a Bomb Calorimeter. The mass of water taken in the Calorimeter was 2000g. Water equivalent of the colorimeter is 530 g. The difference in initial and final temperature is 1.9°C. The elemental analysis showed 92%C, 3.6%H and 1.2%O. Calculate the net calorific value. **5**

Module – IV

7. a) Define the term desalination. With a neat diagram describe flash evaporation and reverse Osmosis. **8**

b) Give in detail the classification of liquid crystal. **7**

c) A sample of water is found to contain 40.5 mg/L $Ca(HCO_3)_2$, 46.5mg/L $Mg(HCO_3)_2$, 27.6mg/L $MgSO_4$, 32.1mg/L $CaSO_4$ and 22.45 mg/L $CaCl_2$. Calculate the total hardness of water. **5**

(Given : Atomic Weights of Ca = 40, Mg = 24, S = 32, O = 16, C = 12, Cl = 35.5, H = 1)

d) Outline the instrumentation and working involved in a colorimeter. **5**

8. a) Explain the primary, secondary and tertiary treatment methods of sewage. 8

   b) Give brief account of the following 7

   i) Nematic   ii) Cholestric

   c) 200ml of a sample of water was tested for alkalinity it did not give any colour with phenolphthalein indicator, but required 20 ml of N/50, H_2SO_4 using methyl orange indicator, state why phonolphthalein did not give any colour. Calculate the alkalinity in ppm. 5

   d) Explain the method for determination of BOD of water sample. 5