SEM 2 – 2 (RC 07-08)

F.E. (Semester – II) Examination, November/December 2014
APPLIED SCIENCE – II
(Physics and Chemistry)
(Revised Course 07 – 08)

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

   b) Give Einstein's theory of stimulated emission. **5**

   c) Find out V-number and also no. of modes each fibre will propagate from the following data. **5**

Fibre Type	Core R.I.	Fractional R. I. diff.	Core radius (μm)	Operating wavelength (μm)
SI	1.448	0.00138	6	1.3
GRIN	1.440	0.00138	8	1.6

   d) Give construction and working of Ruby laser. Draw the necessary diagrams. In what way it differs from He-Ne laser. (give any two differences). **10**

2. a) Give various applications of laser. 5

   b) What are the types of optical fibre ? Discuss each of them separately. Draw the necessary diagrams. 5

   c) Input power required to operate a laser is 0.5 w it emits light of wavelength 5000 A.V. and its efficiency is 1 percent. Find the no. of photons emitted by it per second. 5

   d) Give construction and working of He-Ne laser. Draw energy level diagram showing transitions. In what way it differs from Ruby laser. (give any two difference). 10

Module – II

3. a) What is type-II superconductor ? What is its advantage over type-I superconductor. 5

   b) Explain characteristic X-ray spectra. State Mosley's law. 5

   c) In compton scattering, if the incident radiation is 1.372 A.U., find the wavelength of scattered radiation at an angle of 30°. Also find velocity of recoiled electron. 5

   d) Write a short note on : 10

      i) Production of X-ray by coolidge tube

      ii) Bragg's X-ray spectrometer.

4. a) Describe an experiment to demonstrate the wavenature of electron. 5

   b) What is superconductivity ? Discuss in brief BCS theory of superconductivity. 5

   c) X-ray tube operates at 25 kV. Calculate

      i) the speed at which electrons strike the anode

      ii) the shortest wavelength of X-rays coming from the tube. 5

   d) Derive the expression for compton shift. Discuss different cases with regard to angle of scattering. 10

SECTION – II
(Chemistry)

Module – III

5. a) Describe with a neat diagram how calorific value of a chemical fuel is determined using bomb calorimeter. Explain how and why corrections are made in the determination of calorific value. 10

   b) Define the term Glass Transition Temperature. Outline its importance by giving examples. 5

c) Outline the synthesis and applications of Butyl rubber. 5

d) What are the advantages and disadvantages of photovoltaic cell. 5

6. a) Describe the following methods of polymerization : 10
   i) Suspension polymerization
   ii) Bulk polymerization.

b) Define the term knocking and explain how knocking can be minimized. 5

c) Write a note on reforming of petrol. 5

d) What is a photovoltaic cell ? Explain its working. 5

Module – IV

7. a) Explain the primary, secondary and tertiary treatment methods for sewage. 10

b) Write in brief about :
   i) Nematic
   ii) Cholesteric phases. 5

c) Discuss the applications of liquid crystals in displays and thermography. 5

d) 200 ml 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 phenolphthalein did not give any colour what type of alkalinity is present and calculate the alkalinity in ppm. 5

8. a) What is potable water ? Describe the different stages involved in the treatment of municipal drinking water. 10

b) Describe the different phases occurring in thermotropic liquid crystals. 5

c) Explain the basic principle and instrumentation involved in visible spectrophotometer (colorimeter). 5

d) 25 ml of sewage sample for COD is reacted with 30 ml of $K_2Cr_2O_7$ solution and the unreacted $K_2Cr_2O_7$ requires 12 ml of N/4 ferrous ammonium sulphate solution. Under similar conditions in blank titration, 22 ml of ferrous ammonium sulphate is used up. Calculate COD of the sample. 5
