F.E. (Semester – II) Examination, May/June 2008
(Revised in 2007-08 Course)
APPLIED SCIENCE – II (Physics and Chemistry)

Duration: 3 Hours Max. Marks: 100

Instructions : *i) Answer **one** question from **each** Module.*
*ii) Answer the **two** Sections in **separate** answer books.*
*iii) Draw diagrams **wherever** required.*
*iv) Assume additional data if **required**.*

SECTION – I (Physics)

Physical Constants :

Planck's constant = 6.63×10^{-34} J.S.

Electron charge = 1.6×10^{-19} C

Electron mass = 9.11×10^{-31} kg

Velocity of light = 3×10^{8} m/s

Boltzmann constant = 1.38×10^{-23} J/K

MODULE – I

1. a) How does the propagation of light takes place in an optical fiber ? Explain the term 'mode of propagation' in an optical fiber. **5**

   b) What are lasers ? Explain the principle of holography and the preparation of a hologram. **5**

   c) A laser is characterised by certain energy levels where the ratio of population of two energy levels is 1.132×10^{-28} out of which the upper energy level corresponds to a metastable state. Determine the wavelength of light emitted at 57°C. **5**

   d) Mention the advantages (four) of optical fiber communication over conventional communication system. With the help of energy level diagram explain the working of a gas laser. **10**

2. a) Discuss various properties of laser beam and the physical principle involved in laser action. 5

b) How does holography differ from photography ? Give in brief one engineering application of laser. 5

c) Write short notes on i) use of optical fibers in communication ii) optical resonant cavity. 5

d) Define the terms 'acceptance angle and acceptance cone' of an optical fiber. Derive an expression for numerical aperture of an optical fiber in terms of fractional index change and refractive index of core material. Draw refractive index profile sketch for a multimode step index fiber.

An optical fiber has NA of 0.15 and a cladding refractive index of 1.55. Determine the angle of acceptance of the fiber in water whose refractive index is 1.33. 10

MODULE – II

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

b) Compare the momentum and the kinetic energy of an electron with a de Broglie wavelength of 1 A° with that of a photon having same wavelength. 5

c) Discuss the Meissner effect in superconductors. Give an account of two practical applications of superconductors. 5

d) Explain Bragg's law for X-ray diffraction in crystals. Describe how Bragg's spectrometer is used for determination of wavelength of X-rays. 10

4. a) Explain in brief type-I and type-II superconductors. 5

b) In a coolidge X-ray tube, an electron loses 80% of its energy and produces a single X-ray photon of wavelength 0.03 nm. Determine the accelarating voltage applied to the tube. 5

c) What are matter waves ? Using the concept of matter waves, obtain the Bohr's condition for quantization of angular momentum. 5

d) Describe the experimental support to observe compton effect. Show that the wavelength shift of scattered photons in compton effect depends only on the scattering angle and not on the wavelength of incident radiation. 10

SECTION – II
(Applied Chemistry)
MODULE – III

5. a) Draw a neat diagram of Bomb calorimeter and explain the determination of calorific value. **10**

   b) Explain how the following elastomers are obtained, mention their applications
   i) Neoprene ii) Butyl rubber. **5**

   c) What are conducting polymers ? Give examples. **5**

   d) What is solar grade silicon ? Explain. **5**

6. a) What is meant by reforming ? Explain the principal reactions occurring during reforming process. **10**

   b) Give the preparation, properties and uses of Epoxy resin. **5**

   c) What are elastomers ? Write the structure of natural rubber, mention its deficiences. **5**

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

MODULE – IV

7. a) Explain the electrodialysis method of desalination of water. **10**

   b) Give brief account of the following : **5**
   i) Nematic ii) Cholestric phases

   c) Mention the applications of liquid crystals in displays and thermography. **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 10.0 ml of N/4 FAS solution. Under similar conditions, in blank titration 20 ml of FAS is used up calculate COD of the sample. **5**

8. Define BOD of a sewage. What are its significances ?

   a) How is it determined ? **10**

   b) Explain the liquid crystalline behaviour in PAA homologous series. **5**

   c) Draw the block diagram of photoelectric colorimeter, label and explain the essential parts. **5**

   d) What is hard water ? What are the causes of hardness ? **5**