D 334

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2003.

Second Semester

Chemical Engineering

PH 134 — PHYSICS – II

(Common to Textile Technology, Leather Technology, Polymer Technology, Fashion Technology and Industrial Bio-Technology)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

(Given constants (i) Permitivity of free space $= 8.854 \times 10^{-12}$ F/m

(ii) Planck's constant $= 6.626 \times 10^{-34}$ Js

(iii) Velocity of light $= 3 \times 10^{8}$ m/s

(iv) Charge of an electron $= 1.602 \times 10^{-19}$ C

(v) Mass of an electron $= 9.1 \times 10^{-31}$ kg

(vi) Avogadro's number $= 6.02 \times 10^{26}$ /kg-mole)

1. A positive charge of value 60×10^{-9} C is placed at a distance of 0.84 m from a negative charge of value 80×10^{-9} C in air medium. What force will these charges exert on a positive charge of value 0.21×10^{-6} C placed half way between them.

2. A potential difference of 20 kV is applied to a parallel plate capacitor with a plate area 0.01 m^2. The plates are separated by a dielectric of thickness 2 mm and dielectric constant 4.54. Calculate the capacity of the capacitor and the energy stored in it.

3. State Heigenberg's uncertainty principle. If the uncertainty in position of an electron is 4×10^{-10} m, calculate the uncertainty in its momentum.

4. A neutron of mass 1.675×10^{-27} kg is moving with a kinetic energy 10 KeV. Calculate the de Broglie wavelength associated with it.

5. Distinguish between atomic and molecular spectra.

6. Differentiate between fission and fusion.

7. Calculate the packing factor of a crystal belonging to simple cubic system.

8. A crystal with face centred cubic lattice has density 6250 kg/m^3 and molecular weight 60.2. Calculate its lattice constant.

9. Mention the various steps involved in any Non Destructive Testing Process.

10. How eddy current technique is used for non destructive testing?

PART B — (5 × 16 = 80 marks)

11. (i) Derive Bragg's law of diffraction of X-rays by crystals. (6)

(ii) Explain powder method of crystal structure analysis. (6)

(iii) X-rays of wavelength 0.154 nm are diffracted by (111) planes in a crystal at an angle 30° in the first order. Calculate the lattice parameter. (4)

12. (a) (i) State and prove Gauss law for electrostatics. (8)

(ii) Using Gauss law calculate the electric field intensity near a long charged conductor (line charge). (4)

(iii) A uniformly charged sphere of radius 8 cm has a total charge of 300×10^{-6} C. Calculate the electric field intensity at a point 16 cm from the centre of the sphere, at a point on the surface of the sphere and at a point 4 cm from the centre of the sphere. (outside medium is air). (4)

Or

(b) (i) Derive an expression for the capacity of a capacitor in the form of a cylinder. (6)

(ii) Obtain an expression for the loss of electrostatic energy when two charged conductors are made to share their charges. (6)

(iii) Write the differential form of Maxwell's equations of electromagnetism. (4)

13. (a) (i) What is Compton effect? Obtain an expression for the wavelength of the scattered X ray photons in terms of the wavelength of the incident X ray radiation and scattering angle. (12)

(ii) Calculate the velocity of a moving electron whose total energy increases to 4 times of its initial rest energy. (4)

Or

(b) (i) Derive the time independent Schroedinger wave equation for a particle. Hence obtain the expression for the energy levels of a free particle in an one dimensional potential well. (12)

(ii) An electron is trapped in an one dimensional box of length 0.1 nm. Calculate the energy required to excite the electron from its ground state to the fifth excited state. (4)

14. (a) (i) Describe Stern-Gerlach experiment to justify the vector atom model. (10)

(ii) Explain Raman effect and explain the occurrence of stokes and antistokes lines. (6)

Or

(b) (i) Explain nuclear fission on the basis of liquid drop model of the nucleus. (6)

(ii) Describe with diagram the essential parts of a nuclear power reactor and write down the condition for criticality. (10)

15. (a) (i) Explain the liquid penetrant method for non destructive testing of materials. (6)

(ii) Describe the working of ultrasonic flaw detector for non destructive testing. Mention its advantages and disadvantages. (10)

Or

(b) (i) Explain the principle of X ray radiography and describe the technique to detect the location of the flaws by X rays. (10)

(ii) Describe magnetic particle method used for non destructive testing. (6)
