[Total No. of Questions - 9] [Total No. of Printed Pages - 3]
(2123)

1302

B. Tech 1st Semester Examination

Engineering Physics-I (N.S.)

NS-102

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all, selecting one question from each Sections A, B, C and D. Question 9, Section E is compulsory.

SECTION - A

1. (a) What are various types of diffraction phenomenon? How can these be used to explain the wave theory? Give the difference between interference and diffraction? **(12)**

   (b) Calculate the smallest width the grating must have to resolve two components of sodium D lines in the second order, the grating having 80 lines/mm. The wavelength of the two sodium lines are 5890 Å and 5896 Å. **(8)**

2. (a) What is Brewester's law? What is double refraction? What is a quarter wave plate and half a wave plate? **(12)**

   (b) Explain method of wavelength determination by grating. What is dispersive power of a grating? **(8)**

SECTION - B

3. (a) What is Photoelectric effect? What is meant by photoelectric work function? Derive Einstein's photoelectric equation. **(10)**

   (b) Describe Wien's displacement law and discuss, its meaning and usefulness. **(5)**

(c) Estimate de-Broglie wavelength for electron beam accelerated through a potential difference of 100 Volts. **(5)**

4. (a) Describe an experiment, which explains the concept of matter waves based on particle diffraction phenomenon. **(8)**

(b) Write Maxwell's equations in differential form and express them in the integral form. Explain physical significance of each. **(8)**

(c) Calculate de Broglie wavelength of an electron accelerated through a potential difference of 36 V. **(4)**

SECTION - C

5. (a) What is wave function? What is its physical interpretation and properties. **(8)**

(b) Derive dependent and time independent Schrodinger equations for non-relativistic free particles. **(12)**

6. (a) Discuss the postulates of quantum mechanics. **(8)**

(b) Solve the Schrodinger wave equation for a particle in one dimensional box. Graphically sketch energy levels of the particle for first five energy states in the potential box. Also obtain the first three normalized wave functions and plot them graphically. **(12)**

SECTION - D

7. (a) What is the binding energy of the nucleus? Draw a graph between the binding energy per nucleon and the mass number. What is the significance of binding energy curve? **(10)**

(b) What are various types of elementary particles? How are these classified? **(5)**

(c) Calculate the power produced in a reactor where U^{235} atoms undergo fission at a rate of 6.25×10^{10} per second. Given that energy released per fission is 200 MeV. **(5)**

8. (a) What is nuclear fission? With the help of a schematic diagram explain working of a nuclear reactor discussing all difficulties and necessary conditions for sustaining nuclear chain reaction in it. **(10)**

   (b) Discuss big bang theory about evolution of universe. **(5)**

   (c) State what is meant by binding energy and mass defect with respect to the nucleus. **(5)**

SECTION - E

9. (a) Distinguish between Fresnel and Fraunhofer class of diffraction.

   (b) Define resolving power of a grating.

   (c) Explain Brewster's law.

   (d) Can visible light be used to observe Compton effect? Explain.

   (e) What is Heisenberg uncertainty principle? Write its mathematical form for energy and time.

   (f) Write Schrodinger's (i) time independent and (ii) time dependent equations.

   (g) Explain physical significance of wave function ψ.

   (h) Calculate energy equivalent of 1 atomic mass unit.

   (i) Explain how a fission chain reaction can be controlled.

   (j) Discuss the stability of even-even, even-odd and odd-odd nuclei. **(2×10=20)**

   Use constants: 1 a.m.u. = 931 MeV, Electronic charge, $q = 1.6\times10^{-19}$ Coulomb.

   Planck's constant, $h=6.62\times10^{-34}$ J-s. Velocity of light $c=3\times10^{8}$ m/s, Electron rest mass $m = 9.1\times10^{-31}$ kg.