

Total No. of Questions : 10] [Total No. of Printed Pages : 4

Roll No.

BE-201

B. E. (First Semester) EXAMINATION, April, 2009

(Common to all Branches)

ENGINEERING PHYSICS

(BE-201)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt *one* question from each Unit.

Physical constants :

$$h = 6.63 \times 10^{-34} \text{ J. sec;}$$

$$m_e = 9.31 \times 10^{-31} \text{ kg}$$

$$c = 3 \times 10^8 \text{ m/sec}$$

Unit-I

1. (a) Explain De-Broglie's hypothesis of matter waves. Explain the concept of wave packet associated with particle. Prove that for a relativistic and non-relativistic particle group velocity is equal to the velocity of particle. 10
- (b) What is Compton effect ? How does it explain the particle nature of radiation ? Derive an expression for the frequency of the scattered photons in terms of frequency of the incident radiation and scattering angle. 10

Or

2. (a) Write down the Schrödinger equation for a particle in a three-dimensional box. Solve it to obtain Eigen function and show that the Eigenvalues are discrete. 10

P. T. O.

- (b) Find the energy Eigenvalue for first five excited states of an electron bound in a cube of dimension 10 nm. 5
- (c) An oil drop of mass 10^{-12} gm is floating on the free surface of a liquid. At any instant the position of drop can be determined within the error of 10^{-4} cm. What will be the error in measurement of its velocity ? 5

Unit-II

3. (a) How are the circular fringes obtained in Newton's rings experiment ? Why these fringes are called the fringes of equal thickness ? Why the central fringe is a dark spot when examined in reflected light ? 10
- (b) In a Michelson's interferometer experiment the readings of two consecutive positions of the movable mirror for the maximum distinctness of fringes were found to be 1.2829 mm and 1.5774 mm. If the mean wavelength of Sodium D-lines is 5893 Å, find the difference between the two wavelengths. 5
- (c) What factors determine the resolving power of prism ? 5

Or

4. (a) Explain the conditions for maxima and minima for diffraction at a single slit. 10
- (b) What is the condition which must be satisfied if the second order spectra are to be absent from the grating spectrum ? 5
- (c) Calculate the thickness of the quarter wave plate when the wavelength of the light is equal to 5890 Å and $\mu_o = 1.55, \mu_e = 1.54$. 5

Unit – III

5. (a) What is mass defect ? Draw a curve between the mass defect and nucleon number. What information is obtained from it regarding the stability of the nucleus ? 5
- (b) Discuss qualitatively the liquid drop model given for nuclei ? What are the similarities between liquid drop and nucleus ? 5
- (c) Explain theory and working of cyclotron ? What is the resonance condition in cyclotron ? What are its drawbacks ? 10

Or

6. (a) What are the main components of a nuclear reactor ? Describe the function of each of these components. 10
- (b) Explain the principle and working of Bain bridge Mass Spectrograph ? Show that the mass scale is linear. 10

Unit – IV

7. (a) Explain the concept of effective mass given for electron on the basis of band theory of solids ? 10
- (b) Explain the working of Zener diode and how it can be used as a voltage regulator. 5
- (c) An n -type Ge sample has a donor density of $10^{21}/\text{m}^3$. It is arranged in Hall effect experiment having magnetic field of 0.5 Tesla and current density $500 \text{ A}/\text{m}^2$. Find the Hall voltage if the sample is 3 mm wide. 5

Or

8. (a) Prove that in an intrinsic semiconductor the Fermi Level lies in the middle of the forbidden gap. 10

P. T. O.

- (b) Explain what do you understand by Nanotechnology. 5
- (c) Explain the construction and working of a solar cell and discuss its I-V characteristics. 5

Unit – V

9. (a) Explain three quantum processes occurring when a light wave interacts with matter. Derive the relationship between the Einstein's coefficients. 10
- (b) Explain three and four level pumping schemes used in lasing action ? Which one is better and why ? 5
- (c) Explain Holography technique for recording and reproducing 3-D image of an object. 5

Or

10. (a) Explain with a diagram, construction, working and principle of CO_2 laser and compare it with He-Ne laser. 10
- (b) Explain the propagation of light in an optical fibre. What is maximum angle of acceptance and acceptance cone ? 5
- (c) For an optical fibre having core refractive index 1.55 and cladding refractive index 1.50, calculate : 5
- Critical angle
 - Maximum angle of refraction θ_r with which a ray enters in fibre.