15003

B. Tech 1st Semester Examination

Engineering Physics (CBS)

PH-101

Time : 3 Hours   Max. Marks : 60

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, select one question from each sections I, II, III and IV. Section V (question 9) is compulsory.

SECTION - I

1. (a) How inertial frame differ from non-inertial frame of reference? Obtain Galilean transformation equations and write their consequences.   (6)

   (b) Discuss principle, construction and working of He-Ne laser. Why He is added in more proportion in this laser?   (6)

2. (a) What was the main objective of the Michelson Morely experiment? Discuss this experiment in detail. Write the main inference of this experiment.   (6)

   (b) Derive Einstein's mass-energy relation. Mention few experimental evidences in support of this relation. Find the speed at which a rocket appears to be 85% of its actual length, to an observer at rest.   (4+2=6)

SECTION - II

3. (a) What are the characteristics of SHM? Obtain the differential equation of damped harmonic oscillation. Differentiate between free and forced vibrations   (6)

   (b) What is total internal reflection? Define acceptance angle. numerical aperture. Differentiate between single mode and multimode fibres.   (6)

4. (a) What is attenuation? Explain various types of losses in the optical fibers. How they can be minimised? What is optical window?   (6)

   (b) Discuss the application of the fibres in communication system and sensor system. A communication system uses a 20km fibre having a loss of 3.2dB. What will be output power if the input power is 950µW?   (3+3=6)

SECTION - III

5. (a) State and explain Heisenberg's uncertainty principle. Using this principle show that electrons cannot exist in the nucleus and also find the binding energy of an electron in the atom.   (6)

   (b) Write the postulates of quantum mechanics. Why wave nature of matter is not apparent to our daily observation?   (4)

   (c) A particle is moving in a one dimensional box of width 40A°. Determine the probability of finding the particle inside the box and at interval of 3A° at the centre of the box in its ground state.   (2)

6. (a) Define phase velocity and group velocity. Show that the phase velocity of the de-Broglie wave is greater than velocity of light, but the group velocity is equal to the velocity of the particle with which the waves are associated.   (6)

(b) Derive the time independent Schrödinger's wave equation. (4)

(c) Differentiate between soft and hard x-rays. (2)

SECTION - IV

7. (a) What is meant by Poynting vector? Deduce Poynting vector from Maxwell's equations and discuss its physical significance. (6)

(b) State and explain Meissner effect. Discuss its contradiction with the Maxwell's equation. (4)

(c) What are high temperature superconductors? (2)

8. (a) Write Maxwell's equations in the integral form. Derive Maxwell's fourth equation and discuss its physical significance. https://www.hptuonline.com (6)

(b) Explain isotope effect. How this effect gave the clue for the theory of superconductivity? Discuss BCS theory of superconductivity. (6)

SECTION - V

9. (a) Write postulates of special theory of relativity.

(b) The binding energy of an electron is 13.6eV. Calculate the loss of mass in the formation of one atom of hydrogen

(c) What is stimulated emission?

(d) What is coherence length?

(e) What is the stumbling block in increasing the signal carrying capacity of the fibre with the increase of numerical aperture?

[P.T.O.]

(f) Define bit rate

(g) Write significance of Maxwell's third equation

(h) If the curl of a vector field is zero then what does it signify?

(i) Discuss wave impedance of free space

(j) What is Bremsstrahlung effect?

(k) Can de Broglie waves be electromagnetic or acoustic? Explain

(l) Why superconductivity is a low temperature phenomenon? (1×12=12)