[Total No. of Questions - 9] [Total No. of Pr ed Pages - 4]
(2066)

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B. Tech 2nd 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 Lorentz transformation equations. What is time dilation? (7)

   (b) Discuss principle, construction and working of Ruby laser. Write its important applications. (5)

2. (a) Explain the characteristics of laser beam. Distinguish between spontaneous emission and stimulated emission. What is the role of population inversion and meta stable state in laser? (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. (6)

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SECTION - II

3. (a) Discuss the terms: relaxation time, quality factor and sharpness of resonance. Differentiate between free and forced vibrations. Velocity of radio waves is 4×10^5 km/s, calculate the frequency in megahertz of the station broadcasting at 615m. (4½+1½=6)

   (b) What is critical angle? Define acceptance angle, numerical aperture. Differentiate between step index and graded index optical 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 application of optical fibres as sensor. A step index fibre has core and cladding indices as 1.47 and 1.46 respectively. Calculate the maximum radius allowed for this fibre, if it is supporting only one mode at a wavelength of 1300nm. Also calculate numerical aperture, maximum acceptance angle, critical angle of this fibre. (3+3=6)

SECTION - III

5. (a) State and explain Heisenberg's uncertainty principle. Using this principle show that protons can exist in the nucleus and also determine the binding energy of an electron in the atom. (6)

   (b) What is a wave function? Mention the necessary conditions of a physically acceptable wave function. (4)

   (c) The wave function of a particle confined to move along X-axis is $\psi=b^2x$ for $0<x<1$, and $\psi=0$ elsewhere. Determine the probability of finding the particle between $x=0.25$ to $x=0.55$. (2)

6. (a) Derive the eigen values and eigen functions for a particle in one dimensional box using Schrödinger's wave equation. (6)

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

   (c) Differentiate between continuous and characteristics x-rays. (2)

SECTION - IV

7. (a) What is Poynting vector? State and explain Poynting theorem for the flow of energy in electromagnetic wave. (6)

   (b) Explain soft and hard superconductors from the magnetization curve. (4)

   (c) Write the applications of high temperature superconductors. (2)

8. (a) Write Maxwell's equations in the differential form. Derive Maxwell's fourth equation and discuss its physical significance. (6)

   (b) Explain isotope effect. Discuss the significance of this effect in context of the phenomenon of superconductivity. Write the accomplishments of BCS theory of superconductivity. (6)

SECTION - V

9. (a) Write relativistic form of Newton's second law.

   (b) Mention the condition for stimulated emission to dominate over spontaneous emissions.

   (c) What is optical resonator?

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   (d) Write the equation representing a simple harmonic progressive wave and explain various symbols appearing in it.

   (e) Write two main advantages of optical fibres over the conducting wires.

   (f) Mention the wavelength range over which signal can be transmitted through the optical fibre without much attenuation.

   (g) Define band width.

   (h) Write significance of Maxwell's second equation.

   (i) What is solenoidal field?

   (j) What are de Broglie waves?

   (k) Write momentum and energy operators.

   (l) What are cooper pairs? (1×12=12)