B.TECH,1ST YEAR,2014
ENGINEERING PHYSICS
PAPER CODE:BTPH-101
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M. Marks: 60   Time: 3hrs

NOTE: Section A is compulsory. In addition, attempt any five questions selecting at least two questions from each of the section B & C.

SECTION A

1. (i) Write the expression for magnetic susceptibility of a magnetic material.
   (ii) Give one example for each of a soleniodal and irrotaional vector fields.
   (iii) What does permeability of a medium signifies? State its value for free space.
   (iv) What do you mean by a primitive unit cell?
   (v) Why a three level laser normally provide a pulsed output?
   (vi) What do you understand by "10.5dB/Km@850nm"?
   (vii) What is difference between inertial and non-inertial frames of references?
   (viii) Give two properties of carbon nano-tubes.
   (ix) What is the physical significance attached to the conditions of continuity and single-valued nature of an acceptable wave function?
   (x) A superconducting state behaves according to which type of magnetic material in presence of applied magnetic field having magnitude less than critical value?
                                                                    (2×10=20)

SECTION B

2. (a) State and explain the Ampere's law and express it in differential form. Further explain how Maxwell modified this law to accept this as one of the Maxwell equations.   (6)
   (b) What do you mean by magnetostriction?   (2)
3. (a) What are ferromagnetic domains? Explain their existence in terms of atomic dipole moments.   (4)
   (b) Write a short note on magnetic anisotropy.   (4)
4. (a) Specify three types of possible transitions between two atomic energy levels and derive relations for the Einstein's coefficients.   (5)
   (b) Calculate the ratio of transition rates of spontaneous emission to the stimulated emission for light of wavelength 10^{-6}m and cavity temperature T=100K and hence determine which type of emission will dominate?   (3)
5. (a) Calculate packing fraction for a body center cubic unit cell.   (3)
   (b) What is Bragg's law and how it is used for crystallographic studies   (3)
   (c) What do you mean by Meissner effect?   (2)

SECTION C

6. (a) Describe construction of an optical fiber with help of diagram. Further, describe different factors responsible for loss of signal propagating through a fiber.   (5)

(b) A step-index fiber with RI of core 1.458 and numerical aperture of 0.3 is to be used at 820 nm. Find the core radius if normalized frequency is 75.　(3)

7. (a) Derive Lorentz transformation equations.　(5)

(b) A spaceship moving away from the earth with a speed 0.9c fires a missile in the same direction as its motion, with speed 0.7c relative to the spaceship. What is the speed of the missile relative to the earth?　(3)

8. (a) Solve Schrodinger wave equation for a particle confined to an infinite potential box of width L in order to derive the expression for energy eigen-values.　(5)

(b) Calculate the de-Broglie wavelength associated with the electrons, which are accelerated by a voltage of 50 kV.　(3)

9. (a) Discuss briefly different methods used to synthesize the nanoparticles.　(4)

(b) What do you mean by relativity of simultaneity? Explain it with help of an example.　(4)

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