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[Total No. of Questions: 09] [Total No. of Pages: 02]
Uni. Roll No. …….

Program/ Course: B.Tech. (Sem. 1st/2nd)
Name of Subject: Engg. Physics
Subject Code: BTAS-17102
Paper ID: 15857

Time Allowed: 03 Hours **Max. Marks: 60**

NOTE:

1) **Parts A** and B are **compulsory**
2) **Part-C** has two sections: section C1 and section C2. Attempt one question each from the section C1 and C2.
3) Any missing data may be assumed appropriately

Part – A **[Marks: 02 each]**

Q1.

a) Give classification of superconductors.
b) Define Poynting vector. Give its unit.
c) What is the physical significance of wavefunction?
d) Draw block diagram of fiber optic communication system.
e) "Gravity affects light". Comment on the statement.
f) Can lasing action take place without stimulated emission? Justify your answer.

Part – B **[Marks: 04 each]**

Q2. Derive Lorentz transformation equations. Under what condition these reduce to Galilean transformation equations.

Q3. Write Maxwell's equations and give their significance

Q4. Define nanomaterials and discuss in detail their classification.

Q5. Using London's equations explain Meissner effect (flux expulsion) and flux penetration.

Q6. A plane makes intercepts of $1\,\text{Å}$, $2\,\text{Å}$ and $3\,\text{Å}$ on three crystallographic axes such that a:b:c=3:2:1. Determine Miller Indices of the given plane.

Q7. Find de-Broglie wavelength of a charged particle accelerated to such a high potential that it starts moving with relativistic speeds? Hence modify the expression for the non relativistic case.

Part – C

Section-C1 **[Marks: 12 each]**

Q8(a). Does any kind of energy gap exist in superconductors? If yes elaborate the same and how is it different from that existing in insulators. Hence find the wavelength of an incident photon required to break the cooper pair in a superconducting material having critical temperature 5 K.

or

Q8(b). (i) What kind of pumping is suitable for gaseous and solid state lasers? Give reasons.
(ii) Why He and Ne are mixed together in He-Ne laser? Discuss their roles in the working of He-Ne laser.
(iii) What are the characteristics of light being recorded in a holography? On the basis of these, differentiate holography from photography.

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(iv) Is there any criteria to differentiate Single mode fiber (SMF) and Multi mode fiber (MMF)? Hence check whether the fiber with following specification is a SMF or MMF: a = 25 μ m, N.A. = 0.4 and λ = 800 nm.

Section-C2 **[Marks: 12 each]**

Q9(a). What are the characteristics of a scalar field and vector field? How can we obtain vector field from the corresponding scalar field and hence the derive relation between electric potential and electric field. The scalar potential in a given region is of the form: $V = 3x^2y - y^2z^2$. Find electric field at point (1,-2,-1) and check whether the vector field thus obtained is uniform or not.

or

Q9(b). (i) A wavefunction associated with a moving particle in 1-D is given as:

$$\varphi(x) = \begin{cases} Ae^{-ax} ; & x > 0 \\ Ae^{ax}; & x < 0 \end{cases}$$

Normalize this wavefunction. Hence find the probability to locate the particle in the region 0 to α.

(ii) A rocket is moving away from earth with speed 0.8c. Consider the line joining the centre of earth and rocket as x-axis. At certain instant of time, the rocket fires a missile at an angle of 60^o w.r.t. x-axis with speed 0.6c relative to earth. Find the speed and direction of the missile w.r.t. rocket.

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