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Total number of pages: [02]

Total number of questions: 09

B. Tech. || All || 1<sup>st</sup> Semester

**Engineering Physics**

Subject Code: BTPH-101

Paper ID: (for office use)

Max Marks: 60

Time allowed: 3 Hrs

Important Instructions:

- Section A is compulsory. Each question in this section carries 2 marks.
- Attempt any five questions from Section B and Section C selecting at least two questions each from Section B and Section C. Each question of Section B and Section C carries 8 marks.
- Assume any missing data.

**PART A**

Q. 1. Short-Answer Questions:

- What is the physical significance of divergence of a vector?
- Differentiate between ferro- and ferri- magnetic materials.
- What is X-ray radiography?
- Differentiate between ordinary photography and holography.
- Differentiate between fibre connectors and splices.
- Discuss ether concept.
- What is uncertainty principle?
- Find the surface area to volume ratio of a spherical particle.
- X-rays of wavelength  $2 \text{ \AA}$  suffers first order reflection from (111) crystal plane at an angle of  $45^\circ$ . Calculate the inter-atomic spacing of the crystal.
- Calculate the critical current that can flow through a long thin superconductor of diameter  $10^{-3} \text{ m}$ . Given  $H_c = 7.9 \times 10^3 \text{ Amp/ m}$ .

**PART B**

- Write Maxwell's equations and explain their physical significance. (4)
  - What is dielectric polarization? Discuss the origin of various types of dielectric polarization. (4)
- Derive London first equation for superconductors. On its basis, justify the existence of persistent current in superconductors. (6)
  - What is Meissner effect? (2)
- Derive Bragg's law of X-ray diffraction. Explain Bragg's spectrometer and discuss its application. (6)
  - Find Miller Indices of a plane intercepting the axes at  $1a$ ,  $3b$ ,  $2c$ . Also represent the plane and its direction. (2)
- What is population inversion? (2)
  - Explain the construction, principle and working of a Ruby laser. Why is the output of Ruby laser pulsed? (6)

Contd.

## PART C

- Q. 6. (a) Deduce an expression of acceptance angle of the optical fibre. (5)  
(b) Discuss the physical structure of an optical fibre. (3)
- Q. 7. (a) Deduce expressions for the eigen values and eigen functions of a particle confined to one dimensional box of infinitely high and impenetrable walls. (6)  
(b) Calculate Planck's constant if the velocity of an electron is  $7.3 \times 10^7$  m/s and its de Broglie wavelength is  $0.1 \text{ \AA}$ . (2)
- Q. 8. (a) Establish the relation  $E = mc^2$ . (5)  
(b) Show by direct application of Lorentz transformation equations that  $x^2 + y^2 + z^2 - c^2 t^2$  is invariant. (3)
- Q. 9. (a) Discuss the synthesis and properties of carbon nanotubes. (5)  
(b) What are 1D, 2D and 3D nanoparticles? (3)