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Uni. Roll No.

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Program/ Course: B.Tech. (Sem. 1/2)

Name of Subject: Engineering 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) Write down expressions for electric and magnetic potentials and give their units.
- b) Differentiate between primitive and non- primitive unit cells.
- c) Find surface area to volume ratio of a sphere of radius 'r'.
- d) Give four advantages of optical fibers over copper wires.
- e) Find de-Broglie wavelength of an electron accelerated by a potential of 1MV.
- f) Find the wavelength of electromagnetic radiation that can break a cooper pair in a certain material having critical temperature of 7.1K.

Part - B

[Marks: 04 each]

- Q2. What is the principle of Holography? Discuss the process of developing and reconstruction of a hologram.
- Q3. Derive expression for Einstein's mass energy relation.
- Q4. Discuss in detail ball milling technique for the manufacturing nanomaterials. Also give limitations of this method.
- Q5. Explain why the equation $\vec{\nabla} \times \vec{B} = \mu_0 \vec{J}$ has limited applicability. Hence modify it for variable currents.
- Q6. Using uncertainty principle, show that electrons cannot exist in the nucleus.
- Q7. Derive relation between critical current and critical magnetic field for a cylindrical conductor in the absence of any external magnetic field and hence find maximum current that can be passed through a conductor of radius 3mm, whose critical magnetic field is $5 \times 10^{-3} \text{ A/m}$.

Part - C
Section-C1

[Marks: 12 each]

- Q8(a). (i) Show that intensity of plane electromagnetic waves is directly proportional to square of amplitude. (ii) Apply Time Independent Schrodinger equation to study the motion of a particle confined in a one dimensional box of length L and hence find eigen functions, eigen momentum and eigen energy values. (6+6)

or

- Q8(b). (i) Object A is moving away from earth with velocity 0.6c. Object B is moving with velocity 0.8c at an angle of 120° w.r.t. direction of motion of object A. Find the

direction and magnitude of velocity of object B w.r.t. object A. (ii) Why X-rays are most suitable for studying crystal structure and obtain the relation that governs diffraction of X-rays from a crystal. (iii) Find the spacing between two consecutive lattice planes from a simple cubic system of lattice constant 4 \AA , if Miller indices of the planes are $(0\ 3\ 4)$. (5+5+2)

Section-C2

[Marks: 12 each]

Q9(a). (i) Why a material must become diamagnetic during superconducting transition? Is there any role of lattice vibrations in understanding the behaviour of superconductor? Explain in detail. (ii) The numerical aperture of a step index fiber is 0.3 and the refractive index of core is 1.50. Find refractive index of clad, acceptance angle and critical angle at the core clad interface. Assume that outside medium is air. (iii) What are various types of Carbon nanotubes? Give their applications. (5+5+2)

or

Q9(b). (i) Why a four level laser is better than a three level laser? Hence describe construction, theory and working of any four level laser. (ii) Why Pulse dispersion in optical fiber is more serious problem than attenuation? Hence discuss the types, causes and remedies of different types of pulse dispersion taking place in optical fiber. (6+6)
