B.Tech   (Sem. – 1,2)

ENGINEERING PHYSICS

Subject Code: BTPH-101

M Code: 54105

Date of Examination : 28-01-23

Time: 3 Hrs.   Max. Marks: 60

INSTRUCTIONS TO CANDIDATES:

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION - B & C have FOUR questions each, carrying EIGHT marks each.**
3. **Attempt any FIVE questions from SECTION B & C, selecting atleast TWO questions from each of these SECTIONS B & C.**

SECTION-A

1. **Write briefly:**

    a) Give the physical significance of gradient, divergence and curl of a physical quantity.

    b) Derive the relationship between electric field and potential ($E = -\nabla V$)

    c) Define Meissner's effect in superconductivity.

    d) State Bragg's law of diffraction in crystals.

    e) Differentiate between spontaneous & stimulated emission.

    f) Define acceptance angle and numerical aperture in optical fibers.

    g) Explain the concept of Ether.

    h) Write the characteristics of a well-behaved function.

    i) What do you understand by wave-particle duality?

    j) Write a few biomedical applications of nonmaterials.

SECTION-B

2. a) Write Maxwell's equations in free space in their differential form and derive the EM wave equation.

   b) Prove that the velocity of EM waves in free space is equal to the velocity of light. (6+2)

3. a) Make a comparison of different properties for dia, para, ferro and ferri magnetic materials.

   b) Derive the London equations for superconductivity. (4+4)

4. a) What is the concept of Miller indices? Derive the formula for the distance between two adjacent planes of a simple cubic lattice.

   b) Deduce the Miller indices for planes in each of the following sets which intercept $\vec{a}, \vec{b}$ and $\vec{c}$ at (4+4)

   i) $3a, 3b, 2c$ ii) $a, 2b, c$ iii) $a, b/2, c$

5. a) Define Einstein's coefficients of radiation and derive the relationship between them.

   b) Discuss the construction, working and energy level diagram of Ruby laser. (3+5)

SECTION-C

6. a) Explain the allowed modes in an optical fibre. How are they related to normalized frequency?

   b) Calculate the refractive indices of the core and cladding materials of a fibre from the following data: $NA = 0.22, \Delta\mu_r = 0.012$, where NA is numerical aperture. (5+3)

7. a) Write Lorentz transformation equations and using them derive the expressions for length contract and time dilation in a relative motion.

   b) Derive the relativistic form of Newton's second law of motion when $\vec{F}$ is parallel to $\vec{v}$.
   (5+3)

8. a) Define group and phase velocities of matter waves.

   b) Derive time dependent Schrodinger wave equation. (3+5)

9. Discuss the following techniques for the synthesis of nanoparticles:

   a) Ball milling

   b) Sol-gel technique (4+4)

NOTE : Disclosure of Identity by writing Mobile No. or Marking of passing request on any paper of Answer Sheet will lead to UMC against the Student.