(T) Roll No. .....

PAPER ID—10704

Bachelor of Technology (Civil Engineering), Bachelor of Technology (Mechanical Engineering), Bachelor of Technology (Robotics and Automation)

EXAMINATION, 2025

(Second Semester)

PHYSICS

Time : 3 Hours *Maximum Marks : 70*

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting any *four* questions from Unit II. Q. No. **1** (Unit I) is compulsory. All questions carry equal marks.

Unit I

1. (a) Define electric polarization and its types.

   (b) What are the bound charges ? 2

   (c) State modified equation for curl of magnetic field to satisfy continuity equation. 2

   (d) State Huygens principle. 2

   (e) Differentiate between interference due to division of wave-front and interference due to division of amplitude. 2

   (f) Why does excited helium prefer energy transfer to neon atoms instead of returning to its ground state ? 2

   (g) Explain the various types of electronic materials. 2

Unit II

2. (a) Discuss the boundary conditions for electric field and electrostatic potential. 7

(b) Derive Laplace's equations for electrostatic field. What is its importance in physics ? 4

(c) Prove that the work done in moving a charge from one point to another in an electrostatic field is path independent. 3

3. (a) What is electric potential energy ? Find an expression for the potential energy of n point charges separately placed in different position. 6

(b) Explain the following : 8

(i) Laws of magnetism

(ii) Polar and non-polar dielectrics

(iii) Magnetic domains.

4. (a) What are magnetic materials ? Differentiate between ferromagnetic, paramagnetic and diamagnetic materials on the basis of magnetic moment and domain alignment. 8

(b) Obtain the energy of a charge distribution and also write its expression in terms of electric field. 6

5. (a) What are Newton's rings ? Discuss the formation of Newton's ring by reflected system. Explain how these can be used to find the wavelength of light. 7

(b) Discuss the diffraction pattern formed by Fraunhofer diffraction due to a single slit and show that if the intensity of central maximinum is taken unity, the value of second, third and fourth maxima will be approx : 1/22 : 1/61 : 1/121. 7

6. (a) What is Population Inversion ? Why is it essential for obtaining laser ? Also explain the basic principle of laser action. 5

(b) Explain the free electron theory of metals. Also discuss the concept of density of states in 1, 2 and 3-dimensions. 6

(c) A plane transmission diffraction grating has 30,000 lines in all with grating element 22.8×10^{-5} cm. Calculate the maximum resolving power for which it can be used in the range of wavelength 4000 Å. **3**

7. (a) How does Fermi energy vary with temperature ? Explain. **6**

(b) Explain the principle, construction and working of a dye laser. **4**

(c) Explain the origin of band gap. **4**

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