

Roll No.

Total No. of Questions : 09]

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B.Tech. (Sem. – 1st/2nd)

ENGINEERING PHYSICS

SUBJECT CODE : PH – 101 (2004 – 10 Batch)

Paper ID : [A0122]

Time : 03 Hours

Maximum Marks : 60

Instruction to Candidates:

- 1) Section - A is **Compulsory**.
- 2) Attempt any **Five** questions from Section - B & C.
- 3) Select at least **Two** questions from Section - B & C.

Section - A

Q1) (2 Marks each)

- a) Enumerate different polarization mechanisms in dielectrics?
- b) Iron is a ferromagnetic material but a piece of iron does not ordinarily behave as a magnet. Explain.
- c) Explain the meaning of stimulated emission.
- d) Bring out the differences between step-index and graded-index fibers.
- e) What is the electric flux through a closed surface surrounding an electric dipole? Explain.
- f) Is the earth an inertial frame? If not, why?
- g) Write the Bragg's equation for X-ray diffraction and explain the meaning of various symbols in it.
- h) What is the method of pumping in a Ruby laser?
- i) State the conditions which a physically acceptable wave-function must obey.
- j) Mention some important changes that occur in substances when they change from their normal state to the superconducting state.

Section – B (8 Marks each)

- Q2) a)** Write down the four Maxwell's equations in differential form. Discuss the significance of each. Explain Maxwell's modification of Ampere's law.
- b)** Dielectric constant of a gas at N.T.P. is 1.00074. If the gas is held in an external field of 3×10^4 V/m, calculate the dipole moment of each atom of the gas.
- Q3) a)** What are the distinguishing characteristics of ferromagnetism? Discuss the domain theory of ferromagnetism.
- b)** The magnetic susceptibility of silicon is -4.2×10^{-6} . Find its magnetization and the magnetic flux density when it is placed in magnetic field of strength 1.2×10^5 A/m.
- Q4) a)** What are Einstein's coefficients? Explain their meaning and derive the relation between them.

- b) What is a hologram? How is it produced and how is the image reconstructed from it?
- Q5) a)** What is an optical fiber? Explain the meaning of the terms:
- 1) Acceptance angle
 - 2) Numerical aperture
 - 3) Normalized frequency
 - 4) Fractional change in refractive index
- b) The core diameter of a graded index fiber is 0.05 mm and its numerical aperture is 0.22. If it carries light of wavelength 850 nm, what is the normalized frequency and what is the maximum number of modes that can be propagated through the fiber?

Section – C

(8 Marks each)

- Q6) a)** What was the objective of conducting the Michelson Morley experiment? Describe the experiment. How do you interpret its result?
- b) A spaceship moving away from earth with velocity $0.6c$ fires a rocket whose velocity relative to the spaceship is $0.7c$ away from the earth. What will be the velocity of the rocket, as observed from the earth?
- Q7) a)** What is Moseley's law and what is its significance? How do you explain it on the basis of Bohr's theory?
- b) The first order diffraction of X-rays is found to occur from a crystal at a glancing angle of 9° . Calculate the wavelength of the X-rays and the glancing angle for their second order diffraction if the inter-planar spacing in the crystal is 2.51 \AA .
- Q8) a)** What is the difference between phase and group velocities? Show that the wave group associated with a particle moves with the velocity of the particle. Also find a relation between the phase and group velocities.
- b) X-rays of wavelength 0.144 \AA are scattered from a graphite block. Find the maximum shift in their wavelength and the maximum energy imparted to the recoil electrons.
- Q9) a)** What is Meissner effect? Explain the difference between Type-I and Type-II superconductors.
- b) Determine the critical temperature for aluminium if the magnetic flux penetration depths for aluminium are 16 nm and 96 nm at 2.18 K and 8.1 K, respectively.

