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Roll No.

TPH-101

B. TECH. (FIRST SEMESTER)

END SEMESTER

EXAMINATION, Dec., 2023

ENGINEERING PHYSICS

Time : Three Hours

Maximum Marks : 100

Note : (i) All questions are compulsory.

(ii) Answer any *two* sub-questions among (a), (b) and (c) in each main question.

(iii) Total marks in each main question are **twenty**.

(iv) Each sub-question carries 10 marks.

1. (a) Discuss Fraunhofer diffraction due to N slits. Also, find the ratio of the intensity of secondary and principal maxima. (CO1)

(b) A grating having 15,000 lines per inch produces spectra of a mercury arc. The

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green line of the mercury spectrum has a wavelength of 5461 \AA . What is the angular separation between the first and second order green lines ? (CO1)

- (c) Explain the formation of interference fringes by means of Fresnel's biprism when a monochromatic source of light is used, and derive the expression for the fringe width. How will measure the wavelength of monochromatic light using biprism method ? (CO1)

2. (a) Discuss with suitable diagrams the principle, construction, and working of Helium-Neon laser. (CO2)

- (b) A light ray enters from the air to a fibre. The refractive index of air is 1.0. The fibre has refractive index of core is equal to 1.5 and that of cladding is 1.48. Find the critical angle, refractive index. The acceptance angle and the numerical aperture. (CO2)

- (c) Give construction, working and theory of half-shade polarimeter. (CO2)

3. (a) Explain Michelson-Morley experiment with the neat diagram. How is this experiment helpful to prove that ether medium cannot exist in the universe ?

(CO3)

- (b) What is the length of a meter stick moving parallel to its length when its mass is $\frac{3}{2}$ times of its rest mass. (CO3)

- (c) What are the postulates of special theory of relativity ? Derive Lorentz transformation equations for space and time coordinates and show that these equation becomes the Galilean equations at very low speeds. (CO3)

4. (a) Write Maxwell's equation in differential and integral form. Prove the differential form of Maxwell fourth equation. What are the significance of these equations ?

(CO4)

- (b) Give the main properties of a superconductor ? Explain the distinction between the type-I and type-II superconductors. Describe the effect of magnetic field on superconductors. (CO4)

- (c) Explain the concept of Maxwell displacement current. Show that the electromagnetic waves propagate in free space with the velocity of light. (CO4)
5. (a) State Heisenberg's uncertainty principle and by applying uncertainty principle explain non-existence of electron in nucleus. (CO5)
- (b) State the values of momentum and energy of a particle in a one-dimensional box with impenetrable walls. Find their values for an electron in a box of length \AA for $n = 1$ and $n = 2$ energy states. Given : (CO5)
- $$m = 9.1 \times 10^{-31} \text{ kg}$$
- and $h = 6.63 \times 10^{-34} \text{ J-sec.}$
- (c) Obtain Schrödinger's wave equation for one-dimensional infinite potential box. (CO5)