

**II SEMESTER EXAMINATION, 2022 – 23**  
**Ist year B.Tech. (Common to all branches)**  
**Engineering Physics**

**Duration: 3:00 hrs****Max Marks: 100**

*Note: - Attempt all questions. All Questions carry equal marks. In case of any ambiguity or missing data, the same may be assumed and state the assumption made in the answer.*

Q 1. Answer any four parts of the following (5 X 4=20)

- What is meant by interference of light? State the conditions for the production of well-defined sustained interference pattern.
- Define population inversion. State the methods to achieve the state of population inversion.
- Explain the features and working of He-Ne laser. Why is it superior than Ruby laser?
- Explain Type I and Type II superconductors with examples.
- Explain formation of multiple spectra with grating and find out the condition of missing orders or absent spectra with a grating.
- Derive the expression for acceptance angle of an optical fiber.

Q 2. Answer any four parts of the following (5 X 4=20)

- Calculate the de-Broglie wavelength of a neutron having kinetic energy of 12.8 MeV (Mass of neutron  $1.674 \times 10^{-27}$  kg).
- How many orders will be visible if the wavelength of incident radiation is 5000 Å and the number of lines on the grating is 2620 per inch?
- Two coherent sources whose intensity ratio is 100:1 produce interference fringes. Calculate the ratio of maximum intensity to minimum intensity.
- A silica glass optical fiber has a core refractive index of 1.48 and cladding refractive index of 1.46. Calculate the acceptance angle and numerical aperture of optical fiber.
- Calculate the conductivity of pure silicon at room temperature when the concentration of carriers is  $1.6 \times 10^{10}$  per  $\text{cm}^3$ . Given that  $\mu_e = 1300 \text{ cm}^2/\text{V-s}$  and  $\mu_h = 700 \text{ cm}^2/\text{V-s}$ .
- The critical field for lead is  $1.2 \times 10^5 \text{ A/m}$  at 8 K and  $2.4 \times 10^5 \text{ A/m}$  at 0 K. Find the critical temperature of the material.

Q 3. Answer any two parts of the following (10 X 2=20)

- Explain spontaneous and stimulated emission of radiation. Derive the relation between Einstein's A and B coefficients.
- Explain assumptions of classical free electron theory of metals and derive expression for electrical conductivity in metals.
- Explain Heisenberg uncertainty principle and prove that electrons can not exist inside the nucleus.

Q 4. Answer any two parts of the following (10 X 2=20)

- Derive Maxwell's electromagnetic field equations in differential form with their physical significance.
- Prove that the relation between phase velocity and group velocity of a particle in relativistic motion is given by,  $v_p \times v_g = c^2$
- Explain Rayleigh criterion of resolution. Derive an expression for resolving power of a plane diffraction grating.

Q 5. Answer any two parts of the following

(10 X 2=20)

- a) What is Poynting vector? Derive Poynting theorem for the flow of energy stored in electromagnetic field.
- b) Explain properties of a well defined and acceptable wave function. Derive Schrödinger time-independent wave equation for a moving particle.
- c) Explain construction, working, V-I characteristics & applications of solar cells.

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