1E3102

Roll No.

Total No. of Pages: 4

1E3102

B. Tech. I - Sem. (Main / Back) Exam., - 2025

1FY2-02 Engineering Physics

Time: 3 Hours **Maximum Marks: 70**

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART – A

[10×2=20]

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1 Why are Newton's Rings known as fringes of equal thickness?

Q.2 Why are two lenses used in Fraunhofer diffraction?

Q.3 What is Schrodinger equation?

Q.4 How are coherent waves generated?

Q.5 What is the theory of optical fibre?

Q.6 What are metastable states?

Q.7 Why semiconductor diodes are non-ohmic?

Q.8 Why are bonds formed in solids?

Q.9 What is the basic principle of electro-magnetic wave theory?

Q.10 Why do we need gradient, divergence and curl?

PART – B

[5×4=20]

(Analytical/Problem solving questions)

Attempt any five questions

Q.1 What will be the radius of n^{th} order dark ring in case of -

(i) When a plano convex lens of radius of curvature R_1 is placed on a plano concave lens of radius of curvature R_2.

(ii) When both the plano convex surfaces are in contact at a point.

Q.2 A diffraction grating has a resolving power $\frac{\lambda}{\Delta\lambda} = Nn$. Show that the corresponding frequency range $\Delta\nu$ that can be just resolved is given by $\Delta\nu = \frac{C}{Nn\lambda}$

Q.3 Derive the Schrodinger time dependent equation and discuss the physical meaning of Ψ and Ψ^2.

Q.4 Find the core radius necessary for single mode operation at 800 nm in step index optical fibre with $\mu_{core} = 1.48$ and $\mu_{cladding} = 1.47$. Also find the numerical aperture and maximum acceptance angle.

Q.5 The resistivity of an intrinsic semiconductor is 4.5 ohm-meter at 20°C and 2.0 ohm-meter at 32°C. What is the energy band gap?

Q.6 Show that the energy density and Poynting vector of electromagnetic field are given by $U_{em} = \frac{1}{2}(\varepsilon_0 E^2 + \mu_0 H^2)$ and $S = E \times H$ where symbols have their usual meaning.

Q.7 A LASER beam of wavelength 692.8 nm and aperture 10×10^{-3} m from He-Ne LASER can be focused on an area equal to the square of its wavelength. If LASER source radiates energy at the rate of 20 mw.

Find-(a) angular spread of the beam

(b) Intensity of focused beam

[3×10=30]

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions)

Attempt any three questions

Q.1 Discuss Fraunhofer diffraction due to N slits and derive the conditions of Principal maxima and minima. Show that secondary maxima are invisible in this case.

Q.2 What do you mean by degeneracy? Solve Schrodinger equation for a particle confined in 3-dimensional box and get the wave function and energy values.

Q.3 (a) Discuss the spontaneous and stimulated emissions and derive the relation between Einstein's Coefficients and discus the result.

(b) What do you mean by-

(i) Population inversion

(ii) Pumping

Q.4 What is Maxwell's EM theory? Derive the Maxwell's equations and show that Maxwell's EM wave truly represents light.

Q.5 Write a short note on -

(i) Band theory of solids

(ii) Conductivity in semiconductors and determination of band gap in a semiconductor

---