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2E1003

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2E1003

B.Tech. IInd Semester (Back) Examination, June-2010

Physics

Common to all branches of Engineering

Time : 3 Hours

Maximum Marks : 80

Min. Passing Marks : 24

Instructions to Candidates:

Attempt overall **five questions** selecting **one question** from **each unit**. All questions carry **equal marks**. (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.)

Unit - I

1. a) Distinguish between the rings obtained in Michelson's interferometer and the Newton's rings. (6)
- b) Using the concept of electric vector of em wave. Discuss plane, circularly and elliptically polarized light. (5)
- c) Yellow light ($\lambda = 5890 \text{ \AA}$) illuminates a Michelson's Interferometer. How many bright fringes will be counted as the mirror is moved through 1mm. (5)

OR

- a) Define optical activity and specific rotation. How will you measure specific rotation of glucose solution using Laurent's half shade device? (2+2+4)
- b) Write a short note on anti reflection coatings. (4)
- c) Newton's rings are observed in reflected light of wavelength $5.9 \times 10^{-5} \text{ cm}$. The diameter of 10th dark ring is 0.50 cm. Find the radius of curvature of lens and thickness of air film at the ring. (4)

Unit - II

2. a) Explain Rayleigh criterion for resolution. Deduce an expression for the resolving power of a diffraction grating. (6)
- b) A single slit is illuminated by light of wavelength 6000 \AA . It is placed at a distance of 2 m from screen and first minima is at 2 mm. from the central maxima. Find the width of the slit. (4)
- c) Discuss the construction and reproduction of a hologram. (6)

OR

- a) Derive an expression for intensity of diffracted light in Fraunhofer's diffraction due to single slit. (6)
- b) Light of wavelength $6 \times 10^{-7} \text{ m}$. is incident normally on plane transmission grating having 500 lines per mm. Find angle of diffraction for first and third order diffraction. (5)
- c) Write a note on application of holography in microscopy. (5)

Unit - III

3. a) Explain coherence length and coherence time. (5)
- b) Describe the construction and working of He-Ne laser. (6)
- c) An optical fibre has a core of refractive index 1.40 and a cladding of refractive index 1.35. Determine numerical aperture and the maximum angle of acceptance. (5)

OR

- a) Obtain threshold condition for sustained laser action. (6)
- b) The red cadmium line has wavelength 643.8 nm. If coherent time $\tau_c \sim 10^{-9} \text{ s}$ find the spectral purity of the line. (5)
- c) Show that visibility is a measure of degree of coherence. (5)

Unit - IV

4. a) Show that deBroglie wavelength associated with an electron accelerated with V volts is approximately $\frac{12.27}{\sqrt{V}} \text{ \AA}$. (5)
- b) Discuss time-dependent and time independent Schrodinger's equations. Give physical interpretation of wave function. (6)
- c) Given that the electron density in silver is $5.8 \times 10^{28} \text{ m}^{-3}$. Calculate the fermi energy for free electron gas. What is the speed of electron at this energy? (3+2)

OR

- a) What are the postulates of Sommerfeld's free electron gas model. What do you mean by Fermi energy level? (4+2)
- b) Prove, according to quantum mechanics, that even with particle energy E less than the barrier height U , there is always a finite probability of transmission through the barrier. (6)
- c) Calculate the uncertainty in the position of electron (of mass 9.1×10^{-28} gm) and moving with an uncertainty in speed of 3×10^9 cm/sec. (4)

Unit - V

5. a) Describe Michelson-Morley experiment with the help of neat diagram and discuss its negative results. (6)
- b) Explain the terms avalanche, quenching and dead time. How is quenching achieved in GM tube. (6)
- c) In the laboratory, electrons from two accelerators are projected with the same speed of 2×10^8 m/sec. but in opposite direction. Find the relative velocity of electrons. (4)

OR

- a) Using Lorentz transformations, obtain expressions for length contraction and time dilation. (6)
- b) Give construction, working and applications of scintillation counter. (6)
- c) Find the velocity at which the mass of a particle is double its rest mass. (4)