15/02/10

Roll No. ________________ [Total No. of Pages : 3

B. Tech. Ist Semester (Back) Examination Feb.- 2010
Physics
(Common to all Branches of Engineering)
1E1003

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.*

Unit - I

1. a) With schematic diagram, explain the working of Michelson interferometer. How will you produce circular fringes with it? How will you measure the difference in wavelength between two closely spaced lines. (6)

b) Give a brief account of :

i) Interference filters.

ii) Non-reflection coatings (or Anti reflection coatings) (6)

c) Newton's rings are observed normally in reflected light of wave length 5.9×10^{-5}cm. The diameter of the 10^{th} dark ring is 0.50 cm. Find the radius of curvature of the lens and thickness of the film. (4)

OR

a) Define specific rotation. Describe the construction and the working of a Laurent's half shade polarimeter to determine optical rotation. (6)

b) How would you produce and detect

i) Plane

ii) Circularly polarized and

iii) Elliptically polarized light? (6)

c) A retardation plate of thickness 8.56×10^{-7}m introduces a phase difference in the path of polarized light of wavelength 5890 $\mathring{A}$. The principal refractive indices are μ_o=1.658, μ_E= 1.486. Find the nature of retardation plate. (4)

Unit - II

2. a) Derive an expression for the intensity of diffracted light in the Fraunhoter's diffraction due to a single slit. **(6)**

b) Describe and explain the Rayleigh's criterion of Resolution and obtain an expression for resolving power of a diffraction grating. **(6)**

c) What is the highest order spectrum. Which may be seen with monochromatic light of wave-length 6000 Å by means of a diffraction grating with 5000 lines/cm. **(4)**

OR

a) Describe the method of recording the hologram and reconstruction of image from it. Can holography be studied with ordinary light? **(6)**

b) Explain diffraction at a plane transmission grating. What particular spectra would be absent if the width of the transparencies and opacities of the grating are equal. **(6)**

c) Calculate the minimum number of lines per cm in a 2.5cm wide grating which will just resolve the sodium lines (5890 Å and 5896 Å) in the second order spectrum. **(4)**

Unit - III

3. a) Define spatial and temporal coherence. Illustrate the concept of spatial coherence with the help of young's double slit experiment. **(6)**

b) Explain the essential requirements for producing laser action. Describe the construction and working of semiconductor lasers. **(6)**

c) The coherence length for sodium light is 2.95×10^{-2}m. The wave length of sodium light is 5890 Å. Calculate

i) Number of oscillation & coherence time. **(4)**

OR

a) What do you mean by numerical aperture of an optical fibre? Find the expression for the numerical aperture of a step index optical fibre. **(6)**

b) Describe a He-Ne laser. How is population inversion achieved in this type of laser. **(6)**

c) Calculate the numerical aperture and acceptance angle of fibre with a core index of 1.54 and a cladding refractive index of 1.50. **(4)**

Unit - IV

4. a) Describe compton effect. Drive an expression for compton shift. How does it support the particle nature of light. **(6)**

   b) State Heisenberg's uncertainty principle. Explain its validity by any thought experiment. **(6)**

   c) Calculate the smallest possible uncertainty in position of an electron moving with velocity 3×10^7m/s. **(4)**

OR

   a) Describe Heisenberg's uncertainty principle and it to explain non-existence of electron in nucleus. **(6)**

   b) Derive Schroedinger's time independent wave equation. What is the physical significance of wave function ψ. **(6)**

   c) Explain the meaning of the terms degeneracy and tunneling. **(4)**

Unit - V

5. a) State the postulates of special theory of relativity and deduce from them the Lorentz transformation. **(6)**

   b) Explain the concept of time dilation. Describe experimental verification of time dilation. **(6)**

   c) Calculate the velocity of a particle having Kinetic energy three times the rest mass energy. **(4)**

OR

   a) Describe construction and working of Geiger - Muller counter. Explain the terms dead time and quenching. **(6)**

   b) Derive Einstein's mass energy relation and explain its importance. **(6)**

   c) An ionization chamber is charged to a potential 1000 volts. If its capacity be 50pf. By what percentage its charge would reduce in passing an α-particle producing 2×10^5 ion-pairs. **(4)**
