1E1003

Roll No. : _____ Total Printed Pages : 4

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B.Tech. (Sem.I) (Old Back) Examination, January/February - 2011

Physics

(Common to All Branches of Engg.)

Time : 3 Hours] [Total Marks : 80

[Min. Passing Marks : 24

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

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

1. Nil 2. Nil

UNIT I

1 (i) Explain how Newton's rings can be observed in the laboratory. Why Newton's rings are circular in shape ? How the Newton's rings are used to find refractive index of liquid?

2+2+2=6

(ii) What are antireflecting films? 4

(iii) What is specific rotation? Describe the working of Laurent's half shade polarimeter. How can it be used to determine specific rotation of glucose solution.

1+3+2=6

OR

1 (i) Describe the construction and working of Michelson's Interferometer? How does Michelson's rings differ from Newton's rings?

2+2+2=6

(ii) Plane polarized light passes through a quartz plate with its optic axis parallel to its faces. Calculate the least thickness of the plate for which the emergent beam will be

(a) Plane polarized and

(b) Circularly polarized.

Given $\mu_e = 1.5533$, $\mu_o = 1.5442$ and $\lambda = 5000\ \mathring{A}$.

3+3=6

(iii) How will you distinguish between circularly polarized and unpolarized light?

4

UNIT II

2 (i) Distinguish between Fresnel's and Fraunhofer's classes of diffraction. show that the relative intensities of successive maxima of Fraunhofer diffraction at single slit are :

$$1 : \frac{4}{9\pi^2} : \frac{4}{25\pi^2} : \frac{4}{49\pi^2} :$$

2+4=6

(ii) A diffraction grating has total ruled width 5 cm for normal incidence, it is found that a line of wavelength 6000 $\mathring{A}$ in a certain order superimposed on another line of wavelength 4500 $\mathring{A}$ of the next higher order. If the angle of diffraction is 30°, how many lines are there in the grating?

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(iii) Explain the construction and working of electron microscope. Why the resolving power of electron microscope is greater than that of optical microscope?

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OR

2 (i) Show that the intensity of light diffracted from a plane transmission grating is given by

$$I = I_0 \left(\frac{\sin\alpha}{\alpha}\right)^2 \left(\frac{\sin N\beta}{\sin\beta}\right)^2$$

where symbols carry their usual meanings.

6

(ii) Explain the construction of a hologram and reproduction of an image by hologram using suitable diagrams.

3+3=6

(iii) A sodium discharge lamp produces two intense wavelengths in the yellow region of visible spectrum at 589.0 nm and 589.6 nm. Can transmission grating with 1200 elements resolve principal maxima in the first order ?

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UNIT III

3 (i) What is coherence? Explain temporal and spatial coherence?

(ii) What do you understand by population inversion ? With help of energy level diagram explain how population inversion is achieved to He-Ne laser? 1+2+2=5

(iii) If the fractional change of refractive index of core with respect to cladding is 0.012 and the numerical aperture of the optical fibre is 0.22, then find the refractive indices of core and cladding of the optical fibre. 2+4=6

OR

3 (i) Derive the relation between Einstein coefficients for laser action and discuss the results? 5

(ii) What do you mean by numerical aperture of an optical fibre ? Derive an expression for Numerical aperture of a step index optical fibre? 4+2=6

(iii) The spectral spread of a red cadmium light of wavelength 694.3 nm is 0.001 nm, calculate spectral purity factor, coherence length and coherence time. 2+4=6

UNIT IV

4 (i) What is compton effect? Deduce an expression for shift in wavelength of scattered X-rays by compton scattering? 4

(ii) Derive Schrödinger's time dependent wave equation. What is the physical significance of wave function ψ used in this equation. 2+4=6

(iii) Consider an electron whose total energy is 5 eV approaching a barrier whose height is 6 eV and width is 7 $\mathring{A}$. Find out de Broglie wavelength of incident electron and probability of transmission through the barrier (mass of electron = 9.1×10^{-31} kg, Planck's constant = 6.6×10^{-34} J-sec) 4+1=5

OR 2+3=5

4 (i) Write down Schrödinger's wave equation for a particle enclosed in one dimensional box of size 'a'. Solve it to get eigen values and eigen functions.

6

(ii) What is the density of states in matel? Obtain an expression for the density of states for free electron gas in metals?

6

(iii) In Compton scattering, the energy of an incident x-ray photon is 150 keV and that of scattered photon is 130 keV. Determine the angle of scattering.

4

UNIT V

5 (i) Give basic postulates of special theory of relativity. Derive Lorentz transformation equations.

2+4=6

(ii) Explain the construction and working of a Geiger-Muller counter. Give its important applications.

2+3+1=6

(iii) A rocket ship is 100 m long on the ground. When it is in flight, its length is 99 m to an observer on the ground. What is its speed?

4

OR

5 (i) Give the construction, theory and applications of a scintillation counter.

2+2+2=6

(ii) Write down the formula for the speed of light in a moving medium. Derive Sagnac formula. How it can be used in optical gyroscope?

1+3+2=6

(iii) In a GM counter on an average 10^{10} electrons/count are collected. If count rate is 10 per second, then find the ionisation current.

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