2E1003

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B. Tech. (Sem. II) (Back) Examination, June/July - 2012
203 Physics

Time : Hours] [Maximum Marks : 80
[Min. Passing Marks :

*Attempt any **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 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

UNIT - I

1 (i) Describe construction and working of Michelson's interferometer. How it is used to measure separation in two nearby wavelengths. **6+2**

(ii) Explain how Antireflection coating is achieved by applying interference phenomenon. **4**

(iii) If 20 cm length of solution A causes right-handed rotation of 42° and 30 cm engths of solution B causes left handed rotation of 27°, then what rotation will be caused by 30 cm length of a mixture of the chemically inactive solution of A and B in ratio of 1:2. **4**

OR

1 (i) Describe construction and working of Newton's ring. How will you determine the refractive index of a liquid by this method ? **4+2**

(ii) Define specific rotation and describe construction and working of Bi-quartz polarimeter to determine it. **2+4**

(iii) A phase retardation plate of quartz has thickness 0.1436 mm. For what wavelengths in the visible region (3800-7800 A) will it act as Quarter Wave Plate and Half Wave Plate ? Given μ_o = 1.5443 and μ_e = 1.5533.

4

UNIT - II

2 (i) Discuss the phenomena of Fraunhofer diffraction at single slit and show that the relative intensities of successive maxima are nearly $1:4/9\,\Pi^2 : 4/25\,\Pi^2 : 4/49\,\Pi^2$.

3+5

(ii) Light of wavelength 5000 $\dot{A}$ is incident normally on a single slit of width 1mm. Calculate the intensity for an angle of diffraction of 30°.

4

(iii) Compare the following :
(a) Fresnal's and Fraunhofer's diffraction.
(b) Holography and Photography.

2+2

OR

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

$$I = I_o (\sin\alpha/\alpha)^2 (\sin N\beta/\sin\beta)^2$$

where symbols has there usual meanings.

6

(ii) Explain Rayleigh's criterion of resolution and deduce an expression for the resolving power of plane transmission grating.

2+4

(iii) Discuss the application of Holography in microscopy and interferometry.

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UNIT - III

3 (i) Classify coherence as Temporal and Spatial coherence. Desribe how size of source is related to spatial coherence and monochromaticity to Tempral coherence.

2+4

(ii) Explain the term absorption, spontaneous emission and stimulated emission and derive a relation between Einstein's coefficients. 6

(iii) A laser operates at wavlength of 6000 Å and its spectral line width is 0.1 KHz. For this, laser calculate the Coherence length and quality factor. 2+2

OR

3 (i) Describe the laser action in He-Ne gas laser with energy diagram. How is population inversion achieved in such a laser ? 4+2

(ii) Explain clearly the propogation of electromagnetic wave inside an optical fiber and drive the expression for the numerical aperture of optical fiber. 2+4

(iii) Discuss a technique for obtaining powerful pulses of short duration from Laser source of low power. 4

UNIT - IV

4 (i) Obtain an expression for shift in wavelength of the scattered X-rays in Compton Scattering. 6

(ii) Derive Schrodinger's one dimensional time dependent wave equation and give its physical interpretation and essential requirements of wave function Ψ used in this equation. 4+3

(iii) Find the probability that a particle in a box of width 'a' can be found between x=0 and x=a/n when it is in the n^{th} state. 3

OR

4 (i) Write down wave function for a free particle of mass 'm' trapped in 3-D box of side 'a' and hence obtain an expression for the density of the states for free electron gas in metal and an expression for the Fermi-energy. 8

(ii) What is quantum mechanical tunneling ? Explain by the example of α-decay. 4

(iii) Explain the term degeneracy for particle confined in three dimensional cubical box of side 'a' ?

4

UNIT - V

5 (i) Using principles of special theory relativity derive mass-energy relation.

6

(ii) Derive an expression for "Length contraction" and "Time dilation" in relativistic mechanics. How time dilation is experimentally verified ?

4+2

(iii) A stationary body explodes into two fragments of rest mass 1.5 kg each moving apart at speeds of 0.8 c. Find the rest mss of the body.

4

OR

5 (i) Describe construction and working of Geiger-Muller counter. Explain the term dead time and quenching.

4+2

(ii) Explain the role of Photomultiplier tube in scintillation counter and compare its merits over gas filed counters.

3+3

(iii) Calculate the mass and speed of an electron accelerated to a kinetic energy of 2 MeV.

4