

2E1003

Roll No. : _____

Total Printed Pages : **4****2E1003****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)

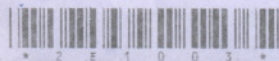
1. _____ Nil _____ 2. _____ Nil _____

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 length 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**

2E1003]**1****[Contd...**

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

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 $1:4/9 \Pi^2 : 4/25 \Pi^2 : 4/49 \Pi^2$.
- (ii) Light of wavelength 5000 Å is incident normally on a single slit of width 1mm. Calculate the intensity for an angle of diffraction of 30°.
- (iii) Compare the following :
- (a) Fresnel's and Fraunhofer's diffraction.
- (b) Holography and Photography.

3+5

4

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.
- (ii) Explain Rayleigh's criterion of resolution and deduce an expression for the resolving power of plane transmission grating.
- (iii) Discuss the application of Holography in microscopy and interferometry.

6

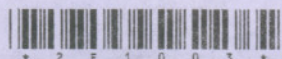
2+4

4

UNIT - III

- 3 (i) Classify coherence as Temporal and Spatial coherence. Describe how size of source is related to spatial coherence and monochromaticity to Temporal 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 wavelength of 6000 \AA 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 propagation of electromagnetic wave inside an optical fiber and derive 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

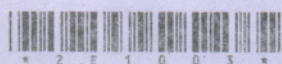
OR

- 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 mass 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 filled counters. 3+3
- (iii) Calculate the mass and speed of an electron accelerated to a kinetic energy of 2 MeV. 4

