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2E1023

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B. Tech. (Sem. II) (Main/Back) Examination, June/July - 2012  
Common for All Branch  
203 Physics - II

Time : 3 Hours]

[Maximum Marks : 80  
[Min. Passing Marks : 24

*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 (a) What is tunnel effect ? Write down Schrödinger equations for potential barrier problem and steps to find out the transmission coefficient of a particle having less energy than the height of potential barrier.

2+2+4

(b) Calculate the probability of transmission that an electron with energy 1.0 eV will penetrate a potential barrier of 4.0 eV when barrier width is  $4.0 \text{ \AA}$ .

8

OR

1 (a) What do you mean by 'Band theory of solids' ? Explain conductor, semiconductor and insulator on the basis of this theory.

2+2+2+2

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1

[Contd...

- (b) For potassium, fermi energy is 2.14 eV and the density of electron is  $1.4 \times 10^{28}/\text{m}^3$ . Find the electron density of a metal for which fermi energy is 4.7 eV.

8

## UNIT - II

- 2 (a) Explain the principle of laser. What are the essential requirements of a laser ? Explain how these requirements are achieved.

2+3+3

- (b) Laser action occurs by stimulated emission from an excited state to a state of energy 30.5 eV. If the wavelength of laser light emitted is 690 nm, what is the energy of the excited one.

8

OR

- 2 (a) What is a hologram ? Explain with suitable diagrams how a hologram is recorded and then reconstructed.

2+3+3

- (b) The pulse width of laser of wavelength 1064 nm is 25 ms. If the average power output per pulser is 0.8 W then

(i) What is the energy released per pulse ?

(ii) How many photons does each pulse contain ?

8

## UNIT - III

- 3 (a) How can you experimentally distinguish between coherent and non-coherent light ? Why is the concept of coherence is of central importance in the study of interference ?

4+4

- (b) A laser beam has a power of 50 mW. It has an aperture of  $5 \times 10^{-3}$  and wavelength 7200 Å. A beam is focussed with a lens of focal length 0.1 m. Calculate the area and the intensity of the image.

8

OR

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2

[Contd...

- 3 (a) Explain how light is propagated in a variable index fibre. Define numerical aperture and acceptance angle. Derive expressions for the same. 4+2+2
- (b) For a step index fibre having core index 1.43 and cladding index 1.4. Calculate :
- (i) Critical angle
- (ii) Critical propagation angle
- (iii) Numerical aperture. 3+3+2

### UNIT - IV

- 4 (a) How will you differentiate between three types of gas detectors viz. ionization chamber, proportional counter and GM counter ? 3+3+3
- (b) An ionization chamber exposed to a beam of  $\alpha$ -particle registers a current of  $4.8 \times 10^{-13}$  ampere. On the average 20  $\alpha$ -particles enter the chamber per second. Assuming that in producing ion pairs 35 eV per ion pair energy is needed, calculate the energy of the  $\alpha$ -particle. 7

OR

- 4 (a) Describe construction and working of Geiger-Muller counter. Explain the terms dead time and quenching. 2+2+2+2
- (b) The efficiency of a GM counter is 90%. If it counts maximum 6000 counters/minute then calculate the paralysis time of counter. 8

### UNIT - V

- 5 (a) Prove that  $\vec{\nabla} \cdot (\vec{A} + \vec{B}) = \vec{\nabla} \cdot \vec{A} + \vec{\nabla} \cdot \vec{B}$  where  $\vec{A}$  and  $\vec{B}$  are differentiable vector functions. 8



- (b) Obtain Maxwell's equations and deduce an expression for the velocity of propagation of a plane electromagnetic wave in a medium of dielectric constant  $\epsilon$  and relative permeability  $\mu$ .

2+6

OR

- 5 (a) Obtain the electromagnetic wave equations, using Maxwell's equation, in an isotropic dielectric medium and show that the speed of wave is less than its speed in vacuum.

4+4

- (b) Define Poynting vector. Derive an expression for it and explain its physical significance for electromagnetic wave in free space.

2+4+2

