

[Total No. of Questions:09]

Uni. Roll No.

Make up Exam Aug 2019

[Total No. of Pages: 2]

Physics.

Program/ Course: B.Tech. (Sem. 2)

Name of Subject: Physics

Subject Code: BSC-101

Paper ID: 15925

Max. Marks:60

Time Allowed: 3 Hours

NOTE:

- 1) Parts A and B are compulsory
- 2) Part-C has two Questions Q8 and Q9. Both are compulsory, but with internal choice
- 3) Any missing data may be assumed appropriately
- 4) Use of scientific calculator is allowed.

[Marks: 02 each]

Part - A

Q1.

- a) Write the units of Poynting vector. What is represented by this vector?
- b) "Focusing of Laser light is better than the ordinary." Why?
- c) What do you mean by Mechanical Impedance matching?
- d) Find the de-Broglie wavelength of a 1.0 mg grain of sand blown by the wind at the speed of 20 m/sec.
- e) What is the physical meaning of Fermi level?
- f) How the surface to volume ratio changes with changing size of a Nanomaterial?

[Marks: 04 each]

Part - B

- Q2. With the help of necessary diagrams, explain the Energy levels for the working of any continuous wave (CW) laser.
- Q3. Describe the role of fibre splicers and couplers in communication through optical fibers.
- Q4. An optical fiber has a N.A. of 0.20 and a cladding refractive index of 1.59. Determine the acceptance angle for the fiber in water which has a refractive index of 1.33.
- Q5. Explain the B.C.S. theory with key note of Cooper pairs in superconductors.
- Q6. A wave packet propagates in a medium, which exhibits normal dispersion. Find the relationship between its phase velocity and group velocity.
- Q7. Suppose an electromagnetic plane wave is moving in free space having electric field component of the form:

$$\vec{E} = \hat{j} E_0 \gamma \left(\frac{2\pi x}{\lambda} \right) \sin \omega t \text{ where } \gamma, \omega \text{ and } \lambda \text{ are constants. Determine the corresponding}$$

\vec{H} field and its direction.

Part - C

[Marks: 12 each]

Q8.

- 1) For a particular mass condition the position of the Fermi energy level for intrinsic semiconductor is below the center of the intermediate energy gap. Justify.

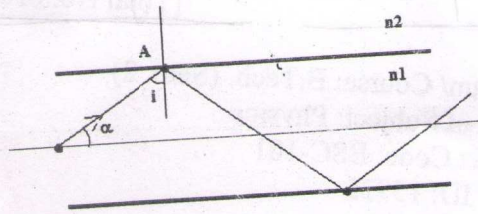
- 2) Show that equation of continuity $\text{div} \vec{J} + \frac{\partial \rho}{\partial t} = 0$ is contained in Maxwell's

Electromagnetic equation.

- 3) Compute the ratio of populations of the two states in a He-Ne laser that produces light of wavelength $6.328 \times 10^{-5} \text{ cm}$ at 27°C .

OR

- 1) An optical fiber of graded index type is made up of a core, where light travels, made of glass of refractive index $n_1 = 1.5$ surrounded by another layer of glass of lower refractive index n_2 .



Find:

- n_2 of the cladding so that the critical angle at the core cladding interface is 80° .
 - Numerical Aperture of the fiber.
 - V-parameter for core radius $50 \mu\text{m}$ and operating wavelength of $0.850 \mu\text{m}$.
 - Number of modes guided in the core.
- For a three level laser system, explain the concept of transition probabilities and derive Einstein equations relating "A" and "B" coefficients.
 - Write a short note on semiconductor recombination.

Q9.

- Consider a 1D box of length $L/4$ in which a particle is trapped. Find the particle wave-function and the corresponding energy for its 2^{nd} excited state.
- A damped oscillator is subjected to a damping force proportional to its velocity. Set up the differential equation of the oscillation. Discuss the under-damped, over-damped and critical damped motions of the oscillator.
- What do you mean by Magnetic Domain? Using domain theory, explain why heating or dropping a magnet can cause it to lose its magnetization.

OR

- What are Nanoparticles, Nanotubes and Nanofilms? Are there any specific health or other risks from such nanoproducts?
- At a certain time, the normalized wave function of a particle moving along X-axis has the form given by

$$\Psi(x) = \begin{cases} x + \eta & \text{for } -\eta < x < 0 \\ -x + \eta & \text{for } 0 < x < \eta \\ 0 & \text{elsewhere} \end{cases}$$

Find the value of η and probability that particle's position lies between $x = \eta/2$ and $x = \eta$.

- What is penetration depth in superconductors? Derive the London differential equation describing the penetration of magnetic field into a superconducting surface.
