Make up Examination Aug 2019 Physics.

[Total No. of Questions:09] [Total No. of Pages: 2]
Uni. Roll No. .....

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.

Part – A **[Marks: 02 each]**

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?

Part – B **[Marks: 04 each]**

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:

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

Part – C **[Marks: 12 each]**

Q8.

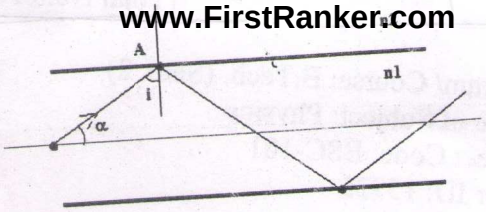
1) For a particular mass condition the position of the Fermi energy level for intrinsic semiconductor is below the center of the intermediate energy gap. Justify.

2) Show that equation of continuity $div.\vec{J} + \frac{\partial \rho}{\partial t} = 0$ 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 6.328×10^{-5}cm at 27^0C.

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:

i. n_2 of the cladding so that the critical angle at the core cladding interface is 80°.

ii. Numerical Aperture of the fiber.

iii. V-parameter for core radius 50 μm and operating wavelength of 0.850 μm.

iv. Number of modes guided in the core.

2) For a three level laser system, explain the concept of transition probabilities and derive Einstein equations relating "A" and "B" coefficients.

3) Write a short note on semiconductor recombination.

Q9.

1) 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 2nd excited state.

2) 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.

3) 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

1) What are Nanoparticles, Nanotubes and Nanofilms? Are there any specific health or other risks from such nanoproducts?

2) 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 $x = \eta$.

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

****

2