

**Section D**

7. (a) With the help of Maxwell equations, show that  $c = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$  for electromagnetic wave in free space and draw the important conclusions. 5
- (b) What do you understand by Poynting vector? Show that  $\vec{S} = \vec{E} \times \vec{H}$ . What does it represent? 5
8. (a) Distinguish between type-I and type-II superconductors. 5
- (b) Explain the BCS theory in detail. 5

**(Compulsory Question)**

9. (a) Write and explain the postulates of special theory of relativity. 5
- (b) Define population inversion. Explain relaxation time and quality factor. 5

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Total Pages : 05

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B.Tech: EXAMINATION, 2022

Semester I (CBCS)

ENGINEERING PHYSICS

PH-101

Time : 3 Hours

Maximum Marks : 60

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Note :** Attempt *Five* questions in all, selecting *one* question from each Sections A, B, C. and D. Q. No. 9 is compulsory.

**Section A**

1. (a) Derive Einstein Mass-Energy equivalence. 4
- (b) Calculate the velocity of rod while its length will appear 80% of its proper length. 2

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(c) What was the objective of conducting Michelson's Morley experiment? Discuss the negative results of the experiment. 4

2. (a) Describe principle, construction, energy level and working of a Ruby laser with neat diagram. 6

(b) What is the significance of Einstein's coefficients? Show that Einstein's coefficient for stimulated emission and absorption are

$$\frac{A_{21}}{B_{21}} = \frac{8\pi h \nu^3}{c^3} \quad 4$$

### Section B

3. Explain different force components acting on a forced and damped harmonic oscillator and establish the differential equation of forced harmonic oscillator. 10

4. (a) What is the importance of various components of a fibre? Define total internal reflection and acceptance angle. 5

(b) A glass clad fibre is made with core glass of refractive index 1.5 and the cladding is doped to give an index difference of 0.0005. Determine : 5

- (i) The cladding refractive index
- (ii) The critical reflection angle
- (iii) The critical acceptance angle
- (iv) The numerical aperture.

### Section C

5. (a) A quantum particle confined to one-dimensional box of width 'a' is known to be in its first excited state. Determine the probability of the particle in the central half. 5

(b) Solve the Schrödinger equation for quantum harmonic oscillator and prove that : 5

$$E_n = \left( n + \frac{1}{2} \right) \hbar \omega$$

6. (a) How are X-rays generated? 5
- (b) Write a short note on Soft and Hard X-rays. 5

- (c) What do you mean by step index and graded index fibre ? Define numerical aperture. 5
- (d) An electron is bound in one-dimensional infinite well of width  $1 \times 10^{-10}$  m. Find the energy values in the ground state and first two excited states. 5

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