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MAR-21-210003

B. Tech. EXAMINATION, March 2021

Semester I & II (CBCS)

ENGINEERING PHYSICS

PH-101

Time : 2 Hours *Maximum Marks : 60*

The candidates shall limit their answers precisely within 20 pages only (A4 size sheets/assignment sheets), no extra sheet allowed. The candidates should write only on one side of the page and the back side of the page should remain blank. Only blue ball pen is admissible.

Note : Attempt *Four* questions in all, selecting *one* question from each Sections A, B, C and D. All questions carry equal marks.

Section A

1. (a) Deduce the expression for expected fringe shift in Michelson-Morley experiment and mention its outcome. **9**

(b) At what speed should a clock be moved so that it may appear to lose 1 minute in each hour ? **6**

2. (a) Explain the term absorption, spontaneous emission and stimulated emission and derive a relation between Einstein's coefficients. **9**

(b) With the help of a neat energy level diagram, explain the working of He-Ne gas laser. **6**

Section B

3. (a) Set up and solve the differential equation of a damped harmonic oscillator. **9**

(b) A body of mass 0.1 kilogram hanging from a spring is oscillating with a period of 0.2 second and an amplitude of 1 meter. Find the maximum value of the force acting on the body and the value of the force-constant of the spring. **6**

4. (a) Describe construction of the optical fiber. Also explain clearly the propagation of electromagnetic wave inside an optical fiber. **9**

(b) Calculate numerical aperture and acceptance angle for an optical fiber from the following data :

μ_1(core) = 1.55 and μ_2(cladding) = 1.50 **6**

Section C

5. (a) Derive Schrödinger's time independent wave equation. What is the physical significance of wave function used in this equation ? **9**

(b) Write a note on 'Bremsstrahlung Effect'. **6**

6. (a) Derive an expression for energy eigen values and eigen functions for one-dimensional simple harmonic oscillator in ground state. **9**

(b) Find the probability of finding a particle between 0.35a and 0.65a where 'a' is the width of the box and particle is in the first excited state. **6**

Section D

7. (a) State and prove the Poynting theorem. Also explain the physical significance of Poynting vector. https://www.hptuonline.com **9**

(b) Using Maxwell equations establish the wave equation for transverse electric and magnetic fields in free space. **6**

8. (a) Show mathematically that a superconductor is not a perfect conductor but a perfect diamagnetic material with zero electrical resistance. **9**

(b) Write a note on BCS theory for super-conductors. **6**

9. (a) Illustrate Einstein mass-energy relation with an example.

(b) Write *two* differences between spontaneous emission and stimulated emission.

(c) Mention *two* differences between step index fiber and graded index fiber.

(d) Define relaxation time for damped oscillator.

(e) What is the importance of Moseley's law ?

(f) Write essential boundary conditions for wave function.

(g) Explain the concept of displacement current.

(h) How do magnetic fields impact on superconductors ?

(i) What is the de Broglie wavelength of an electron with kinetic energy of 120 eV ?

(j) Write two examples for non-inertial frame of reference. **10×1.5=15**