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Total No. of Printed Pages: [01]

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B. Tech. (EE) (Semester – 1st/2nd)
PHYSICS (WAVE AND OPTICS AND INTRODUCTION TO QUANTUM MECHANICS)

Subject Code: BPHYS3101

Paper ID: [18111501]

Time: 03 Hours

Maximum Marks: 60

Instruction for candidates:

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section – A

(2 marks each)

Q1. Attempt the following:

- a. Show that Curl of gradient of a scalar field is zero.
- b. Calculate the divergence of $\vec{F}(x, y) = 3x^2\vec{i} + 2y\vec{j}$.
- c. Why the center of Newton ring with reflected light is dark?
- d. Calculate the refractive index of material if the critical angle is 60° .
- e. What is population inversion?
- f. A 10 mW laser has a beam diameter of 3.2 mm. What is the intensity of the light assuming that it is uniform across the beam?
- g. What is De Broglie's concept of dual nature?
- h. What information can be obtained from Wave-function?
- i. Discuss two properties of laser beam.
- j. In Young's double slit experiment, the fringe width with the light of wavelength 600 nm is 3 mm. Calculate the fringe width for light of wavelength 400 nm.

Section – B

(5 marks each)

- Q2. Define Poynting vector ($\vec{P}$). Show that $\vec{P} = \langle \vec{E} \times \vec{H} \rangle$, where symbols have their usual meanings.
- Q3. Write down four Maxwell's equations and discuss their physical significance.
- Q4. What is Brewster's angle? Obtain the Brewster's formula. Determine the angle of refraction and polarization angle of the polarizer if the refractive index of the polarizer is 1.33.
- Q5. Derive the relation between Einstein's coefficients and discuss the physical interpretation.
- Q6. Define Uncertainty principle. Show that electron does not exist in the nucleus using Uncertainty principle.

Section – C

(10 marks each)

- Q7. Solve the Schrodinger wave equation of a particle in one dimensional infinitely rigid box, Calculate the energy eigenvalues and eigenfunction.
- Q8. Explain the construction and working of He-Ne laser with the help of energy level diagram. Why a narrow discharge tube is used in He-Ne laser?
- Q9. Discuss Fraunhofer diffraction at a single slit and obtain the condition for maxima.