Roll No…….. **Total No. of Printed Pages: [01]**
Total No. of Questions: [09]

B. Tech. (ECE) (Semester – 1st/2nd)
Physics (Wave and Optics and Introduction to Quantum Mechanics)
Subject Code: BPHYS3101
Paper ID: [18111301]

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 $\vec{F}(x, y) = 3x^2 i + 2yj$.
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 $\vec{P} = < \vec{E}\vec{X}\vec{H} >$, 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 Fraunhoffer diffraction at a single slit and obtain the condition for maxima.