Seat No: _____ **Enrollment No: _____**

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

B.Tech. Winter 2019 - 20 Examination

Semester: 3 **Date: 04/12/2019**
Subject Code: 203192201 **Time: 2:00 pm to 4:30 pm**
Subject Name: Optics & Waves **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Objective Type Questions. **(15)**

1.. Young's double slit experiment is an example for division of _____
2.. The formation of fringes in the interference pattern is in accordance with the law of _____
3.. Population Inversion in He-Ne laser is achieved by _____
4.. Ruby laser is a pulse laser due to _____
5.. In CO_2 laser, transition occur between asymmetrical level to_____
6. State Fermat's principle.
7.. Define: limit of resolution.
8.. What do you mean by Total Internal Reflection?
9. Define group velocity of a wave.
10. State Snell's law.
11. Which of the following are coherent sources ?
(A) a 60W and 40 W bulbs (B) two halves of a 60 bulb
(C) two virtual sources obtained by biprism (D) two bulbs each of 40W
12. The interference is produced by division of wavefront in
(A) Newton's rings (B) Michelson Interferometer
(C) Fabry-Perot etalon (D) Fresnel's biprism
13. Ruby laser is a
(A) Solid state laser (B) Gas laser
(C) Liquid state laser (D) None of these
14. The ratio of probabilities of spontaneous emission and stimulated emission is proportional to:
a) υ b) υ^2 c) υ^3 d) υ^4

15. At metastable state an electron lives for
a) 10^{-3} s b) 10^{-7} s c) 10^{-10} s d) 10^{-8} s

Q.2 Answer the following questions. (Attempt any three) **(15)**

A) Draw the diagram for: (i) Simple microscope (ii) Compound microscope.
B) Explain light as an electromagnetic wave.
C) Find the ratio of population of two states in He-Ne laser that produces light of wavelength 6328 Å at 300K.
D) In Newton's ring experiment, the diameters of 4^{th} and 12^{th} dark rings are 0.400 and 0.700 cm respectively. Find the diameter of 20^{th} ring.

Q.3 A) How Newton's ring are formed?.Discuss the experimental arrangement to determine the refractive index of a transparent liquid by Newton's rings. **(07)**
B) Derive the laws of reflection with the help of Fermat's principle. **(08)**

OR

B) What do you mean by Einstein coefficients A & B? Derive the relation between them. **(08)**

Q.4 A) Derive the equation for stationary waves on a string. **(07)**

OR

A) Distinguish between Fresnel and Fraunhoffer diffraction. Derive an expression for intensity **I** for single slit diffraction. **(07)**
B) Describe the construction and working of He- Ne laser with detail energy level diagram. Also explain why it is superior to Ruby laser. **(08)**