

## FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, JUNE 2019

(CUCSS—PG)

Physics

PHY 4E 13—LASERS AND FIBRE OPTICS

(2012 Admissions)

Time : Three Hours

Maximum : 36 Weightage

**Part A***Answer all questions.**Each question carries 1 weightage.*

1. What are the modes of a wave guide ?
2. Explain the modal analysis for a step index wave guide.
3. Define numerical aperture of an optical fibre.
4. Explain about step index monomode fibres.
5. What is q-switching ?
6. What are Einstein coefficients ?
7. What is temporal and spatial coherence ?
8. What are the different applications of a RUBY laser ?
9. Distinguish between photography and holography.
10. What is spatial frequency filtering ?
11. Explain about optical power meters.
12. What is an optical attenuator ?

(12 × 1 = 12 weightage)

**Part B***Answer any two questions.**Each question carries weightage of 6.*

1. Derive the laser rate equations for a three level laser system.
2. Explain the working of CO<sub>2</sub> lasers and dye lasers.
3. Derive the wave equations for a step index optical fibre.
4. Discuss the numerical aperture, acceptance cone and total internal reflection with reference to fibre optics.

(2 × 6 = 12 weightage)

**Turn over**

**Part C**

Answer any **four** questions.

Each question carries weightage of 3.

1. What is a laser induced fusion ? What are the laser energy requirements for a fusion reaction ?
2. Explain the principle of Q-Switching and mode locking.
3. Explain the working of a semiconductor laser with a neat diagram.
4. What are step index fibres ? How do they differ from graded index fibre ?
5. What is meant by numerical aperture of an optical fibre ? Calculate the numerical aperture and acceptance angle of a fibre having refractive indices  $n_1 = 1.421$ ,  $n_2 = 1.402$  for the core and cladding respectively.
6. What is V-number? Calculate the v -number for a fibre of core diameter  $46 \mu\text{m}$  with core and cladding of refractive indices 1.56 and 1.50 respectively at a wavelength of propagating wave is 1300 nm. Also calculate the number of modes that the fibre can support.

(4 × 3 = 12 weightage)