

## M.Sc. 3rd Semester Examination, 2021

### PHYSICS

**Course Title: Laser Physics and Nonlinear Optics-I**

**Course Code: 303ME(B)**

**Course ID: 32453**

**Time: 2 Hours**

**Full Marks: 40**

*The figures in the right hand side margin indicate full marks.  
Candidates are required to give their answers in their own words  
as far as practicable.*

1. Answer *any five* questions: 2x5=10
  - (a) What is the difference between MASER and LASER?
  - (b) What are the stable and unstable optical resonators?
  - (c) Define line shape function.
  - (d) What are the threshold condition for a laser to lase?
  - (e) Explain the term paraxial ray.
  - (f) Clearly indicate the levels responsible for laser action in a Helium-Neon laser.
  - (g) Is a two level system a suitable one for laser action?
  
2. Answer *any four* questions: 5x4=20
  - a) Obtain the ABCD coefficients and hence the focal distance of a lens-like media. 5
  - b) Obtain the wave equation in a quadratic index of media. 5
  - c) Show that the population inversion is necessary condition in order to get a laser. 5
  - d) What are the active- and passive-mode-locking? Discuss in detail different types of active and passive mode locking. 1+4=5

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- e) Discuss the basic principle operation of Ruby laser with necessary energy level diagram. 5
- f) What a rate equation is? Obtain the rate equation for a three level laser system. 5

5

3. Answer *any one* question: 10x1=10

- a) Write down the rate equations of four level laser and obtain the condition of population inversion in four level laser. Why the pumping is more convenient in four level laser than in three level laser. (2+5) + 3 = 10
- b) What is Q-switching? Discuss the Q-switching methods by electro-optic effect and rotating prism method. 2+8=10
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