

Roll No. ....

**DD-752**

**M. Sc. (Fourth Semester)  
EXAMINATION, 2020**

PHYSICS

Paper Second

**(Laser Physics and Applications)**

*Time : Three Hours*

*Maximum Marks : 80*

**Note :** Attempt all the *five* questions. *One* question from each Units is compulsory. All questions carry equal marks.

**Unit—I**

1. Explain spontaneous and stimulated emission with Einstein's quantum theory of radiation. 16

*Or*

What do you mean by Line Broadening mechanism ?  
Explain Homogeneous Broadening in brief.

**Unit—II**

2. Discuss the construction, working and energy level diagram of He-Ne laser. What is the role of helium ? How is this laser superior to Ruby laser ? 16

**P. T. O.**

*Or*

What are the fundamental modes of vibration of CO<sub>2</sub> ?  
Discuss the use of N<sub>2</sub> gas in the production of CO<sub>2</sub> laser. Explain the lasing principle in CO<sub>2</sub> laser using energy level diagram.

### Unit—III

3. Show that the output of mode locked laser is a series of pulses at time interval of  $\frac{2bd}{c}$ , where  $b$  is refractive index of material,  $d$  is distance between cavity end mirrors and  $c$  is velocity of light in vacuum. Also show that output has peak power equal to  $N$  times the average power, where  $N$  is the total number of modes. 16

*Or*

What do you mean by Giant pulses ? Explain Q-switching technique to produce Giant pulses.

### Unit—IV

4. Explain and illustrate the following :
- |                                       |   |
|---------------------------------------|---|
| (a) Hyper-Raman effect                | 8 |
| (b) Photo-acoustic Raman Spectroscopy | 8 |

*Or*

Explain Stimulated Raman Scattering (SRS) with regards to the following questions : 16

- |  |  |
|--|--|
| (a) How does SRS differ from ordinary Raman scattering ?                 |  |
| (b) Why in experiment of SRS, anti-Stokes radiations observed as cones ? |  |

**Unit—V**

5. Write the principle and structure of optical fibre. Calculate acceptance angle and show that numerical aperture depends on refractive indices of core and cladding materials. 16

*Or*

Write the application of laser in the field of chemistry, medicine and biology.