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24-PH-42

**M.Sc. IV SEMESTER [MAIN/ATKT] EXAMINATION
JUNE - JULY 2024**

PHYSICS
Paper - II
[Laser Physics]

*[Max. Marks : 75]**[Time : 3:00 Hrs.]**[Min. Marks : 26]*

Note : Candidate should write his/her Roll Number at the prescribed space on the question paper.
Student should not write anything on question paper.
Attempt five questions. Each question carries an internal choice.
Each question carries **15 marks**.

- Q. 1 a)** Describe the conditions necessary to achieve population inversion in a laser medium ? (05 Marks)
- b)** For a certain laser transition, the spontaneous emission coefficient $A_{21} = 10^8 \text{ s}^{-1}$ and the wavelength of emitted light is 600 nm. Calculate the corresponding stimulated emission coefficient B_{21} . (10 Marks)

OR

- a)** What is Laser Pumping Phenomena ? Explain laser pumping in two level lasing system ? (05 Marks)
- b)** Explain the role of cavity resonators in achieving the threshold condition for laser oscillation. (05 Marks)
- c)** Describe the basic principle of laser operation. How does it differ from ordinary light source ? (05 Marks)
- Q. 2 a)** What are the vibrational modes of resonator and how do they affect the properties of laser beam ? (05 Marks)
- b)** Explain the concept of open resonator and its application in laser systems. (05 Marks)
- c)** Draw the various type of resonators with their names ? (05 Marks)

OR

- a)** Explain spatial coherence and its significance for laser beams. How does it differ from temporal coherence ? (05 Marks)
- b)** What factor contribute to the high directionality of laser beam compared to conventional light sources ? (05 Marks)
- c)** Define monochromaticity in the content of lasers. How is it quantitatively measured ? (05 Marks)

P.T.O.

Q. 3 a) Explain the working principle of Ruby Laser. Discuss its energy levels and transition process. (12 Marks)

b) Calculate the output power of CO₂ laser if the input electrical power is 500 w and the efficiency of the laser is 15% (03 Marks)

OR

a) Describe the construction and operation of an He-Ne Laser. What are its typical application. (12 Marks)

b) A He-Ne laser emits light at 632.8 nm and has a power output of 5 mw. Calculate the number of photons emitted per second. (03 Marks)

Q. 4 Discuss the various applications of laser in medicine. How do laser improve surgical procedure and treatments ? (15 Marks)

OR

Explain the concept of harmonic generation in non - linear optics. What are second and third harmonic generation. (15 Marks)

Q. 5 Write down notes on (**any three**) - (15 Marks)

- i) Self focusing and optical mixing.
- ii) Use of Lasers in Hole drilling and cutting.
- iii) Process of light amplification in laser.
- iv) Working of CO₂ laser.
- v) Compare two level and three level laser system.

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