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Fifth Semester B.E. Degree Examination, Jan./Feb. 2021

Lasers and Optical Instrumentation

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Derive the expression for Einstein relations and hence obtain the rate of spontaneous emission to rate of stimulated emission. (08 Marks)
- b. What is population inversion? Explain the attainment of a population inversion. (08 Marks)
- c. At what temperatures the rates of spontaneous and stimulated emission equals (take $\lambda = 500 \text{ nm}$). At what wavelength are they equal at room temperature ($T = 300^\circ \text{K}$)? (04 Marks)

OR

- 2 a. Draw the construction set up of Ruby Laser and its energy level diagram. Explain the operation of it. (10 Marks)
- b. Explain the construction and characteristics of semiconductor lasers. (10 Marks)

Module-2

- 3 a. Explain about frequency stabilization of LASER. (10 Marks)
- b. What is Mode Locking? Explain about active mode locking and passive mode locking. (10 Marks)

OR

- 4 a. With necessary schematic and equations, explain about distance measurement using Beam Modulation Telemetry. (10 Marks)
- b. With a neat schematic diagram, explain the application of holography in computer memories. Mention its advantages and disadvantages. (10 Marks)

Module-3

- 5 a. With a neat sketch, explain about the electromagnetic spectrum. (10 Marks)
- b. List and explain the standards for optical fiber communications. (10 Marks)

OR

- 6 a. With necessary sketches, explain about the polarization sensitive materials. (10 Marks)
- b. Define single mode and multimode fibers. Distinguish between step index and graded index fibers. (10 Marks)

Module-4

- 7 a. With necessary sketches, explain about the two types of photonic crystal fibers. (10 Marks)
- b. Explain about the glass and plastic fiber materials. (10 Marks)

OR

- 8 a. Define Amplifier noise. Explain about various system applications of optical amplifiers. (10 Marks)
- b. With necessary schematic diagram, explain about the construction and operation of Raman amplifiers. (10 Marks)

Module-5

- 9 a. Discuss the application of fiber optic laser system in Cardiology. (10 Marks)
- b. Explain about the photodynamic therapy in Oncology. (10 Marks)

OR

- 10 a. Explain about the application of Endoscopic Nd:YAG Laser therapy in gastroenterology. (10 Marks)
- b. Explain the applications of fiberoptic laser systems in orthopedics. (10 Marks)

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.