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B.E. (Instrumentation & Control)

b - LASER APPLICATIONS IN INSTRUMENTATION

(2008 Course) (Elective - I) (Semester - I) (406264)

Time : 3Hours]   *[Max. Marks :100*

Instructions to the candidates:

1) Answer three questions from section I and section II.

2) Answer to the two sections should be written in separate books.

3) Neat diagrams must be drawn wherever necessary

4) Use of electronic pocket calculator is allowed.

5) Asume suitable data if necessary.

SECTION-I

Q1) a) Calculate the ratio of rates of spontaneous and stimulated emissions for a tungsten filament lamp operating at temperature of 1030K with average frequency to be 5.4 x 10^{14} Hz.   **[5]**

b) Estimate the relative populations of two energy levels such that a transition from the higher to the lower will give visible radiations of 560 nm at room temperature (T = 300K).   **[5]**

c) Discuss any three the properties of Laser?   **[6]**

OR

Q2) a) Write a short note on the process of absorption, spontaneous and stimulated emissions of radiation.   **[8]**

b) Discuss the significance of Einstein relations in emissions of radiation.**[8]**

Q3) a) Explain the construction and working of any gas laser.   **[9]**

b) Classify the laser products for safety standards?   **[9]**

OR

Q4) a) What are different laser system components? Explain each in short.**[12]**

b) Estimate the efficiency of GaAs laser operating well above threshold. The refractive index of material is 3.5 and laser cavity length is 0.1 mm. The loss coefficient is 600 per meter length and the internal quantum efficiency is 0.8.   **[6]**

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Q5) a) Classify the basic optical interferometers? **[8]**

b) Describe subjective and objective speckles in detail. **[8]**

OR

Q6) a) Describe the electronic speckle pattern interferometer (ESPI) for displacement measurement. **[8]**

b) Describe the speckle in single point interferometers. **[8]**

SECTION-II

Q7) a) Explain the performance parameters of Laser Velocimeter. **[8]**

b) Differentiate between time domain and frequency domain processing of the Doppler signal? **[8]**

OR

Q8) a) Explain the time domain processing of Doppler signal in detail. **[8]**

b) Discuss the performance parameters of operation of laser velocimeter?**[8]**

Q9) a) Write short note on Sagnac effect. **[8]**

b) Describe the all fiber FOG configuration. **[8]**

OR

*Q10)*a) Write short note on Ring Laser Gyroscope. **[8]**

b) Explain in detail the Fiber Optic Gyroscope. **[8]**

*Q11)*a) A thin strip of the hologram undergoing stress parallel to the x-axis is illuminated by a He-Ne laser. The fringes are localized in a plane having slope of 1.5 per unit length in x-direction and the fringe spacing is found to be 1 mm. Hence find the strain. **[8]**

b) Explain the any one applications of holographic interferometer that you know. **[10]**

OR

*Q12)*Write a short notes on:

a) Holographic Interferometer. **[9]**

b) Applications of holographic interferometer. **[9]**

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