

M.TECH. LASER SCIENCE AND TECHNOLOGY 1ST YEAR 2ND SEMESTER - 2019

LASER AUTOMATION AND IN-PROCESS SENSING & LASER SAFETY

Time: 3hrs

Full Marks: 100

Answer any *four* questions
Assume suitable data if necessary.

- Discuss about the safety rules for all lasers, regardless of output power level.
 - With the help of neat sketches explain the three measurement situations for power through apertures for laser beams of circular cross-section.
 - With suitable sketch explain beam reflections. 9 + 10 + 6
- What are the different laser safety signs?
 - Discuss about the beam hazards and the non-beam hazards with the use of lasers.
 - Explain absorption, Lambert's law and optical density. Also find out an expression of optical density. 8 + 8 + 9
- Discuss the time domain parameters for the response of step input to second order system.
 - A second order system has a natural frequency of 5 Hz and a damping ratio of 0.62. If the excitation frequency of the system is 7 Hz, determine the error due to the proximity of excitation frequency with the natural frequency of the system.
 - The following equation characterizes the dynamic response of a certain system

$$\frac{dI}{dt} = C(I - I_0)$$

where, I_0 = indicated output, I_i = input, C = constant.

Determine the transfer operator form of the equation. What is the order of the system? 10 + 6 + 9

- A first order system is subjected to a ramp input. Find out response and dynamic error of the system.
 - A first order system having an input of sine wave pattern is required to measure signals with frequency response of 1120 cycles per second. If an amplitude inaccuracy of 5% is permissible, calculate the maximum time constant and time lag at 85 cycles per second. 13 + 12
- For a CW laser the pulse energy is 50 mJ and pulse duration is 10 ns. What is the peak power? If the repetition frequency is 10Hz for the above problem what is the average power for the pulse laser? Explain them with suitable diagram.

b) Find out the expression of irradiance at $1/e$ position. Hence, find out an expression of d_{fwhm} .

c) Discuss about beam propagation.

8 + 8 + 9

6. a) Discuss the principles of risk assessment. Explain the two primary factors which are involved in assessing this.

b) Discuss the different types of controls for laser use.

c) A 1 mW HeNe laser beam with a divergence of 0.5 m rad enters the I. Find the irradiance on the retina if the focal length of the eye, from cornea to retina, is equal to 1.7 cm.

10 + 5 + 10