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# B.M.S. College of Engineering, Bengaluru-560019

**Autonomous Institute Affiliated to VTU**

## May 2023 Semester End Main Examinations

**Programme: B.E.** **Semester: III**
**Branch: Electronics and Instrumentation Engineering** **Duration: 3 hrs.**
**Course Code: 19EI3PCLOI** **Max Marks: 100**
**Course: Laser and optical Instrumentation** **Date: 15.05.2023**

**Instructions**: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

**Important Note:** Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.



### UNIT - I

| | | | |
|---|---|---|---|
| 1 | a) | Explain the construction and working principle of He-Ne Laser with relevant energy level diagrams. | **10** |
| | b) | Describe Q-switching method to obtain "GIANT PULSE". | **10** |

**OR**

| | | | |
|---|---|---|---|
| 2 | a) | Explain the construction and working principle of CO2 Laser with relevant energy level diagrams. | **10** |
| | b) | Discuss frequency stabilization technique and explain how it is achieved by asymmetric power method. | **10** |

### UNIT - II

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|---|---|---|---|
| 3 | a) | With the help of neat diagram, discuss on how beam modulation telemetry can be used to measure intermediate distance. | **08** |
| | b) | Explain how Laser Doppler Velocity meter (LDV) used to measure the velocity of fluids. | **08** |
| | c) | Write any four Laser characteristics and its application. | **04** |

### UNIT - III

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|---|---|---|---|
| 4 | a) | Derive an expression for Numerical Aperture of step index fibre with necessary diagrams. | **07** |
| | b) | Calculate the critical angle of incidence θc and the largest angle the ray can have with the axis of step-index fibre with core and cladding refractive indices of 1.54 and 1.51 respectively. Also, calculate the full acceptance angle. | **05** |
| | c) | What is Intermodal dispersion? Derive the expression for maximum intermodal dispersion $\Delta t_{max}$, | **08** |

## UNIT - IV

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|---|---|---|---|
| 5 | a) | Distinguish between Extrinsic and Intrinsic fibre optic sensors and also list advantages of fibre optic sensors in comparison with conventional electric and electronic sensors. | **06** |
| | b) | With a neat sketch explain the basic principle of measuring the temperature using fluro-optic temperature sensor. | **06** |
| | c) | Discuss the basic principle of measuring temperature based on variation of wavelength and black body radiation using fibre optic temperature sensor. | **08** |

**OR**

| | | | |
|---|---|---|---|
| 6 | a) | Write a note on polarimetric fibre sensors and mention its applications. Describe with a sketch the operation of remote sensing polarimetric temperature sensor. | **06** |
| | b) | How small displacements are measured using an active multiple mode fibre? | **06** |
| | c) | Illustrate the working principle of phase modulated optical fibre sensors using Mach-Zhender interferometer. | **08** |

## UNIT - V

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|---|---|---|---|
| 7 | a) | Fibre optic gyroscope measures the rate of angular rotation using Sagnac effect- explain its operating principle, derive an expression for phase shift and mention its application. | **08** |
| | b) | Discuss the basic instrumentation principle used in measuring the current using optical fibre. | **06** |
| | c) | Discuss how fibre optic sensor can be used for monitoring structural defects in the building. | **06** |

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