

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- B			
Subject Code & Name	Instructions Hours per Week			Credits			
	L	T	P	L	T	P	Total
DIR2E3: Optical and Laser Instrumentation	3	1	2	3	1	1	5
Duration of Theory Paper: 3 Hours							

CONTENTS

Unit I

Laser Fundamentals: coherence; Spatial and Temporal, Laser theory; absorption, Spontaneous and Stimulated emission, Population inversion, pumping, Einstein coefficient, Resonators, mirrors and modes, Laser output, Q switching, modulation of output by different techniques.

Unit II

Laser Systems & Instrumentation: Principle and construction of different Laser sources-solid state, gas, He-Ne Gas laser, Ruby Laser, CO₂ laser, semiconductor and free electron lasers. Tunable lasers etc., Lengths, displacement and shape measurement; laser heterodyne, Laser Doppler and particle image velocimetry

Unit III

Laser applications: LIDARs (Light Detection And Ranging), Laser alignment, gauging inspection and Laser machine vision, laser material processing, Laser applications to chemical and environmental Analysis, Laser-induced fluorescence, Temperature measurement techniques, Laser Tweezers: Single-dual-and multiple-beam tweezers, and applications.

Unit IV

Holography and Speckle based NDT: Principle of Holography, Holographic Interferometry; Double exposure, Time averaged, Real time H.I., Laser speckle techniques; speckle photography/ interferometry, and digital speckle pattern interferometry and applications of laser speckles, Lengths, displacement, Velocity, slope and shape measurement etc., Optical coherence tomography: biomedical applications.

Unit V

Fiber Optic Sensors: Basics of Optical fiber as sensing device, classification of fiber sensors, intensity, phase, frequency, wavelength modulated sensors, measurement of temperature, pressure, liquid level, displacement, flow, electric and magnetic fields.

Books Recommended:

- [1] Optical Electronics : Ghatak & Thygarajan, Cambridge University Press
- [2] Basics of Holography : P. Hariharan, Cambridge University Press
- [3] Optical Metrology: Kjell J. Gåsvik, John Wiley & Sons, Ltd, 2013
- [4] Optics: Eugene Hecht, Pearson Education Ltd., 2014
- [5] Fiber Optic Sensors, Second Edition, Shizhuo Yin, Paul B. Ruffin, Francis T.S. Yu, CRC Press, 2008