

5 <sup>th</sup> Semester	REI5D004	<b>Fibre Optics and Instrumentation</b>	L-T-P 3-0-0	3 CREDITS
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## Fibre Optics and Instrumentation

### Module I:

(15 Hours)

#### **Optical Sources:**

Light emitting diodes (LED), Materials for LED, Types of LEDs, Principle of operation, Quantum efficiency, Light Intensity, Modulation capability, Output Power, LED drive circuits  
Laser Diode: Laser fundamentals, Absorption and emission of radiation, conditions for amplification by stimulated emission, threshold condition for laser oscillation, resonant frequencies, quantum efficiency, semiconductor laser, modulation of laser diode, radiation pattern, optical transmitters, laser drivers

#### **Optical Detectors:**

PIN photodetector, impulse response and frequency response, Avalanche Photo Diode (APD), photodiode sensitivity, photodetector Noise, noise Sources, signal-to-noise ratio in a photodetector, speed of Response, photomultiplier tubes, Phototransistor, solarcells

### Module II:

(10 Hours)

#### **Optical Fibre:**

Fibre materials, modes in step index fibre (TE and TM modes only), numerical aperture in graded index ((GI)) fibres modes in GI fibre  
Power launching and coupling:  
Source-to-fibre power launching, power launching calculation, equilibrium numerical aperture, lensing schemes for coupling improvement

### Module III:

(10 Hours)

#### **Optoelectronic Instrumentation:**

Modulation techniques: intensity, polarization, interference, electro-optic, electromagnetic;  
Sensing techniques for displacement, pressure, acceleration, flow, current and voltage

measurement, Fiber optic gyroscope, Distributed fiber optic sensors- OTDR and OFDR principles. (Chapter 11, 11.2-11.3.5, 11.3.9, 11.4-11.6 and 11.9 of B-2)

**Books:**

- [1] A. Ghatak and K. Tyagrajan: Introduction to Fiber Optics: Cambridge University Press, New Delhi, 2004. (Chapter 2, Sections 7.2-7.3, Chapter 3, Sections 4.3,8.2, 17.2, 17.8, Section 11.3, 11.6, Chapter 12, Chapter18).
- [2] John M. Senior, Optical Fibre Communications, Principles and Practice, 3rdEdn, Pearson, 2010.
- [3] Optical Fiber Communication by Gerd Keiser, 4th Edition, McGraw Hill International Edition
- [4] R.P.Khare: Fibre Optics & Optoelectronics, Oxford University Press, New Delhi, 2010.
- [5] Subir Kumar Sarkar : Optical Fiber and Fiber optic communication system, S. Chand and Company Private Limited, New Delhi (4th Revised Edition 2007).

***Digital Learning Resources:***

Course Name: FIBER-OPTIC COMMUNICATION SYSTEMS AND TECHNIQUES  
Course Link: <https://nptel.ac.in/courses/108/104/108104113/>  
Course Instructor: Prof. K. Pradeep Kumar, IIT Kanpur