

Course Code	Course Name	Credits
26PH506	FIBER OPTICS AND NON-LINEAR OPTICS	04

Course Objectives

- Understand the basic idea fiber optical sources
- Analyze the communication components that suits optical communication
- Learn about the transmission characteristics of optical fibers
- Understand the fundamentals of non-linear optical techniques
- Understand the materials required for NLO communication systems

Learning Outcomes

After completion of the course, students will be able to:

- Explain optical sources such as LEDs and LASERS.
- Describe fiber optic communication systems and components.
- Analyze losses, dispersion, and transmission characteristics.
- Understand nonlinear optical effects in fibers.
- Apply nonlinear materials in photonic applications.

Unit 1 - Fiber Optical Sources (11 Hrs.)

Overview of optical communication systems, requirements of optical sources, spontaneous and stimulated emission, LED structure and types, LASER diode principles, population inversion, comparison of LED and LASER, basics of source-fiber coupling.

Unit 2 – Fiber Optic Communication Components And System (12 Hrs.)

Block diagram and working of optical communication system, components (transmitter, fiber, receiver), detectors (PIN, APD), types of optical fibers, losses (absorption, scattering, bending), basic dispersion, WDM and TDM concepts, applications.

Unit 3 - Transmission Characteristics Of Optical Fibers (12 Hrs.)

Attenuation and its causes, dispersion types (modal, chromatic, polarization), pulse broadening, bandwidth-distance relation, basic nonlinear effects, methods to reduce losses and dispersion.

Unit 4 – Non Linear Optics (12 Hrs.)

Introduction to nonlinear optics, linear vs nonlinear response, optical susceptibility (basic), types of non-linear effects in optical fibers: self-phase modulation (SPM), cross-phase modulation (XPM), and four-wave mixing (FWM) – stimulated scattering effects: stimulated Brillouin scattering (SBS) and stimulated Raman scattering (SRS), impact on communication systems, mitigation techniques.

Unit 5 - Non Linear Optical Materials (13 Hrs.)

Introduction to nonlinear materials, second and third order effects, types of materials, phase matching concept, second harmonic generation, frequency conversion, applications in photonics.

Reference Books:

1. D.C. Agarwal, Fiber Optic Communication, Sultan Chand, New Delhi(2009).
2. John M. Senior, Optical Fiber Communications, Prentice Hall India, 2nd Edition (2005).
3. B. B. Laud, Lasers and Non-Linear Optics, New Age International Publishers, New Delhi (2008).
4. Govind .P. Agrawal, Nonlinear Fiber Optics, Third Edition, Academic Press (2001).
5. Govind. P. Agarwal, Fiber-Optics Communication Systems, 3rd Edn. JohnWiley and Sons, Singapore (2003).

Websites and eLearning Sources:

1. https://onlinecourses.nptel.ac.in/noc20_ee79/preview

COs and Bloom's Taxonomy Mapping – 26PH506

Course Outcomes	On successful completion of this course, students will be able to	BTL
CO1	Recall and explain the fundamental concepts of optical sources such as LEDs and LASERs used in fiber optic communication.	K1, K2
CO2	Apply the principles of fiber optic communication systems and analyze the role of system components.	K3
CO3	Analyze attenuation, dispersion, and transmission characteristics of optical fibers.	K4
CO4	Evaluate nonlinear optical effects and their influence on signal transmission in optical fibers.	K5
CO5	Design and interpret applications of nonlinear optical materials in photonic and communication systems.	K6

BTL (Bloom's Taxonomy Level) - K1 – Remembering, K2 – Understanding, K3- Applying, K4 – Analyse, K5- Evaluate and K6 - Create

Relationship Matrix – 26PH506

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)						Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	3	2	1	1	1	1	3	2	1	1	1	1	1.58
CO2	3	3	2	1	1	1	3	3	2	1	1	1	1.92
CO3	3	3	2	2	1	1	3	2	3	2	1	1	2.00
CO4	3	3	2	2	1	1	3	3	2	3	2	1	2.17
CO5	3	2	3	2	2	1	3	3	3	2	2	2	2.33
Total													2.00

Mean Score: 3- High, 2- Medium/Moderate, 1-Low

