Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NPHD515	Fibre Optics and Applications	3	0	0	3

Prerequisite: Optics, Electrodynamics, Laser Physics and Technology.

Course Objective

- To educate the students about science and technology of optical fibres
- To specialize and prepare them for research and development for academics and industry.

Learning Outcomes

After completing the course, students will learn

- Physical principles working behind optical fibres and systems, techniques of preparation of optical fibres
- Basics of light guiding in an optical waveguide, wave guide structures and their properties.
- Various applications e.g. communication, sensing and fiber lasers

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	**Introduction:** Step-index fibers, numerical aperture, dispersion in single mode fibers, material and waveguide dispersion, graded-index fibers, attenuation in optical fibers, birefringence; Fiber fabrication techniques, Photonic crystal fibers.	8	The students will also learn basics of fiber and dispersion, loss of light propagated through it and finally different fiber fabrication methods.
2	**Propagation of light**: Light waves in a homogeneous medium, wave propagation in planner waveguide, cylindrical fiber, single and multimode waveguides, concept of TE and TM modes	8	In this section students will learn basics of light propagation in various waveguide structures, modes formation and their consequences. to optics in isotropic and anisotropic materials.
3	**Optical sources and detectors**: Principles and characteristics of light emitting diodes (LED), heterojunction LEDs, principle and characteristics of laser diode, heterostructure laser diodes; Principle of p-n photodiode, p-i-n photodiode, Avalanche photodiode, heterojunction photodiode	10	This section devotes to various advanced light sources and detectors used in fiber communication, their working principles and characteristics.
4	**Fiber Optic Communication:** Fiber couplers, multiplexing strategies- optical TDM, FDM and WDM, hybrid multiplexing, coherent optical detection and communication and techniques	7	This section introduces various devices/methods used to establish a good fiber communication. Students will learn about fiber couplers and multiplexing strategies.
5	**Fibre based devices:** Erbium-doped fibre amplifiers and lasers, Fibre Bragg gratings. Optical fibre sensors: Intensity modulated sensors, Phase modulated sensors, Spectrally modulated sensors, Optical temperature Sensor, Mach- Zehnder interferometer.	9	From this section, student will learn various applications of optical fiber e.g. fabrication of fiber lasers and use of fiber in refractive index, temperature, pressure sensing
	Total	**42**	

Textbooks:

1. An Introduction to Fiber Optics; Ajoy Ghatak, K. Thyagarajan; Cambridge University Press; 1998.
2. Fiber optics and optoelectronics, R.P. Khare, Oxford University Press; 2013.
3. Optoelectronics and Photonics: Principles and Practices, S.O. Kasap, Prentice-Hall; 2001.

Reference Books:

1. Optical Fiber Communications Principles and Practice, 3rd Edition, John M. Senior, Prentice Hall; 2009.
2. Integrated optoelectronics: Waveguide optics, Photonics, Semiconductors, Karl J. Ebeling, Springer; 2011
3. Optics, Eugene Hecht, Addison-Wesley; 2001.Optical waves in layered media, Pochi Yeh, Wiley, 2005.
4. Principles of Optics, Max Born & Emil Wolf, Cambridge University Press, 1999.
5. Physics of Optoelectronic Devices, Chuang, S. L., Wiley-Interscience, 1995.