

COURSE TITLE : OPTICAL FIBRE COMMUNICATION
COURSE CODE : 5045
COURSE CATEGORY : E
PERIODS/WEEK : 4
PERIODS/SEMESTER : 52/5
CREDITS : 4

TIME SCHEDULE

Module	Topics	Periods
1	Fundamentals of optics and optical fibers	13
2	Optical sources and detectors	13
3	Basic optical fiber communication system	13
4	Transmission characteristics of optical fibers	13
Total		52

Course general outcome :

Module	GO	On completion of the study of this course the students will be able :
1	1	To know the fundamentals of optics
	2	To understand optical fibers
2	3	To understand optical sources
	4	To understand optical detectors
3	5	To understand optical amplifiers
	6	To understand optical transmission and reception
4	7	To understand transmission losses and measurement
	8	To understand the elements of optical fiber communication system

GO - General Outcome

On the completion of the study the student will be able :

MODULE I FUNDAMENTALS OF OPTICS AND OPTICAL FIBERS

1.1.0 To know the fundamentals of optics

- 1.1.1 To state absorption, scattering and dispersion
- 1.1.2 To describe the principle of light transmission in a fiber, total Internal reflection, numerical aperture, acceptance angle

1.2.0 To understand optical fibers

- 1.2.1 To describe the ray types - meridional, skew and axial rays
- 1.2.2 To describe elements of physical optics

- 1.2.3 To explain the optical fiber modes and configurations
- 1.2.4 To explain various optical fiber types – based on transmission mode and on refractive index profile
- 1.2.5 To describe different types of fiber materials - glass, plastic optical fiber
- 1.2.6 To explain the advantages of optic fiber

MODULE II VARIOUS OPTICAL SOURCES AND DETECTORS

2.1.0 To understand optical sources

- 2.1.1 To state optical process in semiconductors - energy band, direct and indirect band gap
- 2.1.2 To explain the structure of surface emitting and edge emitting LEDs
- 2.1.3 To explain the modulation of LED
- 2.1.4 To explain the theory of Laser action such as absorption and emission of radiation, population inversion, stimulated emission
- 2.1.5 To explain the Laser diode structure and radiation pattern

2.2.0 To understand optical detectors

- 2.2.1 To explain the principle of photo-detection
- 2.2.2 To explain the structure and working principle of PIN photodiode
- 2.2.3 To explain the structure and working principle of avalanche photodiode
- 2.2.4 To compare various photodiodes

MODULE III BASIC OPTICAL FIBER COMMUNICATION SYSTEM

3.1.0 To understand optical amplifiers

- 3.1.1 To explain the basic optical communication system block diagram
- 3.1.2 To explain the basic concept of optical amplifiers
- 3.1.3 To explain the various types of optical amplifiers - SOA, Raman, EDFA

3.2.0 To understand optical transmission and reception

- 3.2.1 To explain the block diagram of optical transmitter
- 3.2.2 To explain the block diagram of optical receivers
- 3.2.3 To explain the block diagram of optical transceivers
- 3.2.4 To explain the basic idea of wavelength division multiplexing (WDM)

MODULE IV TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS

4.1.0 To understand transmission losses and measurement

- 4.1.1 To explain absorption losses, linear and nonlinear scattering losses, fiber bend losses, intra and inter mode dispersion losses
- 4.1.2 To explain the methods of measurement of attenuation losses

4.2.0 To understand the elements of optical fiber communication system

- 4.2.1 To describe fiber connector and splicer, different types of fiber couplers such as three and four port couplers, star couplers
- 4.2.2 To explain the optical fiber directional coupler - principle and applications
- 4.2.3 To describe optical isolators and circulators
- 4.2.4 To describe beam splitters and optical modulators

CONTENT DETAILS

Module I Fundamentals of optics and optical fibers

Fundamentals of optics - principle of light transmission in a fiber - total internal reflection - numerical aperture - acceptance angle - absorption, scattering and dispersion - optical fibers - the ray types - meridional, skew and axial rays - elements of physical optics - optical fiber modes and configurations - various optical fiber types - based on transmission mode and on refractive index profile - different types of fiber materials - glass, plastic - optical fiber - advantages

Module II Various optical sources and detectors

Optical process in semiconductors - energy band, direct and indirect band gap - LED structure - surface emitting and edge emitting LEDs - modulation of LED - theory of laser action - absorption and emission of radiation, population inversion, stimulated emission - laser diode structure and radiation pattern - optical detectors - principle of photo-detection - PIN photodiode - avalanche photodiode - compare various photodiodes

Module III Basic optical fiber communication system

Optical communication system - block diagram - basic concept of optical amplifiers - types of optical amplifiers - SOA - Raman - EDFA - optical transmission and reception - optical transmitter - optical receivers - optical transceivers block diagrams - wavelength division multiplexing (WDM)

Module IV Transmission characteristics of optical fibers

Transmission losses - absorption losses, linear and non linear scattering losses, fiber bend losses, intra and inter mode dispersion losses - methods of measurement of attenuation losses.
Elements of optical fiber communication system - fiber connector and splicer, different types of fiber

couplers - three and four port couplers - star couplers - optical fiber directional coupler - principle and applications - optical isolators and circulators - beam splitters and optical modulators

Text Books

1. Fibre Optic Communication - Systems and Components - Vivekanand Mishra
2. Sunita P Ugale - Wiley India
3. Optical Fibre Communication - Gerd Keiser - Fourth edition
4. Optical Fibre Communication - John M Senior
5. Introduction to Fibre Optics - Ajay Ghatak and K Thyagarajan