Course Code	Course Title	L	T	P	C
1152EC128	OPTICAL COMMUNICATION SYSTEMS AND NETWORKS	3	0	0	3

a) Course Category

Program Elective

b) Preamble

Fiber optic communication systems and networks provide the basic concepts of optical networks, components, optical sources, detectors and amplifiers also it relates the different networking topologies.

c) Prerequisite

Analog communication system

d) Related Courses

Mobile Communication, Optical and microwave communication

e) Course Outcome

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Explain the passive and active components of optical communication	K2
CO2	Describe the principle and operation of the optical sources and detectors such as LASER & APD	K2
CO3	Summarize the basic concepts of optical networks	K2
CO4	Describe about the SONET/SDH and architecture of Optical Transport Network	K2
CO5	Discuss the elements of WDM networks and its potential applications	K2

f) Correlation of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L	L	-	-	-	-	-	-	-	-	-	-	-	-
CO2	L	L	M	L	-	-	-	-	-	-	-	-	-	-
CO3	M	M	L	M	-	-	-	-	-	-	-	-	-	-
CO4	L	M	M	M	-	-	-	-	-	-	-	M	L	-
CO5	M	L	L	L	M	-	-	-	M	-	-	M	L	-

g) Course Content

UNIT I OPTICAL COMPONENTS 9

Couplers, Isolators and Circulators, Multiplexers and Filters: Grating - Diffraction Pattern - Bragg Gratings Fiber - Fabry- Perot Filters. Multilayer Dielectric Thin-Film Filters – Mach - Zehnder Arrayed Waveguide Grating - Acousto-Optic Tunable Filter, High Channel Count Multiplexer Architectures, Optical Amplifier: Stimulated Emission - Spontaneous Emission - Erbium-Doped Fiber Amplifiers, Raman Amplifiers - Semiconductor Optical Amplifiers, Switches, Wavelength Converters.

UNIT II SOURCES AND DETECTORS 9

Direct and indirect Band gap materials, LED structures -Light source materials -Quantum efficiency and LED power - Modulation of a LED, Laser Diodes: Modes and Threshold condition - Rate equations External Quantum efficiency - Resonant frequencies - Laser Diodes - Temperature effects, Introduction to Quantum laser, Physical Principles of Photodiodes: PIN Photo detector - Avalanche Photodiodes(APD) - Signal-to-Noise Ratio - Comparison of Photo detectors.

UNIT III INTRODUCTION TO OPTICAL NETWORKS 9

Telecommunications Network Architecture – Services - Circuit Switching - Packet Switching, Optical Networks-Multiplexing Techniques - Generation of optical Networks - The Optical Layer - Transparency and All-Optical Networks, Optical Packet Switching – Wavelengths - Frequencies and Channel Spacing - Wavelength Standards, Optical Power and Loss, Network Evolution, Nonlinear Effects: Self-phase Modulation - Cross-phase Modulation - Four Wave mixing, Solitons.

UNIT IV SONET/SDH 9

SONET, SDH and Optical Transport Networks (OTNs): SONET and SDH - SONET multiplexing hierarchy - Frame structure - Functional Component - problem detection – concatenation, Architecture of Optical Transport Networks (OTNs): Digital wrapper - in-band and out-of band control signaling - Importance of Multiplexing and multiplexing hierarchies - SONET multiplexing hierarchies - SDH multiplexing hierarchies - New Optical Transport, OTN layered Model, Generic Framing Procedure (GFP).

UNIT V WDM NETWORK ELEMENTS 9

Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers - OADM Architectures - Reconfigurable OADMs, Optical Cross connects, All-Optical OXC Configurations, WDM-MUX/DEMUX

Routed Networks, Ultra High Capacity Networks, Photonic Switching, Potential applications of optical networks.

Total 45 Hrs

h) Learning Resources

Text Books

1. Rajiv Ramaswami and Kumar Sivarajan, "Optical Networks Practical Perspective", 2nd Edition, Morgan - Kaufmann Publishers.

2. Uyless N. Black, Front Royal, Virginia, “Optical Networks, Third Generation Transport Systems”, Prentice Hall Publishers.

Reference Books

1. Achyut K. Dutta, Niloy K. Dutta, Masahiko Fujiwara, “WDM Technologies: Optical Networks” Elsevier Academic Press
2. Mukherjee, Biswanath, “Optical WDM Networks”, Springer Books, 2006
3. Joseph C Patios, "Fiber Optical Communications", Prentice Hall International 2004, 5th Edition
4. G.P.Agrawal: `Nonlinear Fiber Optics’, Academic Press. 2001 ,3rd Edition

Online Resources

1. **http://nptel.ac.in/downloads/117101054/**
2. www.nptel.iitm.ac.in/foc.
3. http://www.rp-photonics.com,
4. http://electronicsforu.com
5. www.utdallas.edu/~torlak/courses/ee4367/lectures/FIBEROPTICS.pdf
6. http://nptel.ac.in/courses/117101002/downloads/Lec01.pdf
7. https://onlinecourses.nptel.ac.in/noc17_ph01/preview

Practice Aspects

1. TOOL TO BE USED: Optispice, Optisystems