

GANPAT UNIVERSITY									
FACULTY OF ENGINEERING & TECHNOLOGY									
Programme		Bachelor of Technology				Branch/Spec.		Electronics and Communication Engineering	
Semester		VII				Version		1.0.0.0	
Effective from Academic Year			2026-27			Effective for the Batch admitted in			July 2023
Course Code		2EC71PE05		Course Name		Optical Devices and Networks			
Teaching Scheme					Examination Scheme (Marks)				
(Per week)	Lecture (DT)		Practical (Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	0	1	0	4	Theory	40	60	100
Hours	3	0	2	0	5	Practical	30	20	50
Pre-requisites									
Understanding of fiber-optic fundamentals, semiconductor physics, and network theory.									
Course Outcomes									
On successful completion of the course, the students will be able to:									
CO1	Understand fundamental principles of optical fibers, light propagation, and optical communication basics.								
CO2	Analyze the operation, performance, and characteristics of optical sources, detectors, passive components, and integrated optical devices.								
CO3	Evaluate optical amplifiers, WDM systems, modulation formats, and link design considerations in optical communication.								
CO4	Understand and analyze optical switching, routing, protection mechanisms, and advanced optical network technologies.								
Theory Syllabus									
<b>Unit</b>	<b>Content</b>								<b>Hrs.</b>
<b>1</b>	<b>Fundamentals of Optical Communication:</b> Fundamental of optical fiber communication, the historical development of optical networks, light propagation principles, Snell's law, total internal reflection, acceptance angle, numerical aperture, and V-number. Different types of optical fibers such as step index, graded index, and single-mode fibers are discussed along with attenuation mechanisms—scattering, absorption, and bending losses. Dispersion phenomena including material, waveguide, and modal dispersion.								<b>6</b>
<b>2</b>	<b>Optical Sources, Detectors &amp; Basic Component:</b> Characteristics, structures, and operation of LEDs, Laser Diodes (FP-LD, DFB-LD), and VCSELs. Photodetectors: PIN and APD diodes. Basic passive components—optical connectors, splices, couplers, splitters, filters, isolators, and circulators.								<b>8</b>
<b>3</b>	<b>Optical Amplifiers &amp; Integrated Photonic Devices:</b> EDFA operation, gain flattening, pumping techniques, saturation effects, SOAs, and Raman amplifiers. Integrated devices such as Mach-Zehnder modulators, electro-absorption modulators, optical switches, planar waveguides, and photonic integrated circuits (PICs). Wavelength-selective components like arrayed waveguide gratings (AWGs), ring resonators, and micro-photonic filters.								<b>7</b>
<b>4</b>	<b>Optical Transmission Systems &amp; WDM Networks:</b> Point-to-point links, long-haul terrestrial and submarine systems, and metro/core optical network architectures. Wavelength Division Multiplexing (WDM) and Dense WDM (DWDM). channel spacing, grid standards, multiplexing/de-multiplexing techniques, WDM filters, OADM, ROADM, and wavelength management. Modulation formats (NRZ, RZ, DPSK, DQPSK, OFDM, coherent detection), dispersion compensation (DCF, FBG, DSP-based), and nonlinear effects such as SPM, XPM, FWM, and SBS/SRS. Link design concepts: OSNR, power budgeting, rise time budgeting, penalties, and amplifier placement.								<b>12</b>
<b>5</b>	<b>Optical Switching, Routing, OTN, and Modern Network Technologies:</b> Optical cross-connects (OXC), wavelength routers, wavelength-selective switches (WSS), and optical packet and burst switching. routing and wavelength assignment (RWA), network survivability, protection/restoration schemes, and path computation in optical mesh networks. Optical Transport Network (OTN) framing, SONET/SDH, GMPLS control plane, traffic								<b>12</b>

	engineering, and multi-layer coordination are covered. elastic optical networks, flex-grid WDM, space division multiplexing (SDM), multicore fibers, photonic switching fabrics, and optical networking for 5G/6G and data centers	
<b>Practical Content</b>		
Practical assignments and tutorials are based on the above syllabus.		
<b>Text Books</b>		
<b>1</b>	Optical Fiber Communications, John M. Senior, Pearson Education	
<b>Reference Books</b>		
<b>1</b>	Fiber-Optic Communication Systems, Govind P. Agrawal, Wiley	
<b>2</b>	Optical Communication Networks Biswanath Mukherjee, McGraw-Hill	
<b>ICT/MOOCs Reference</b>		
<b>1</b>	<a href="https://nptel.ac.in/courses/117104127/">https://nptel.ac.in/courses/117104127/</a>	

<b>Mapping of CO with PO and PSO:</b>															
	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 0	P O 1	P O 2	P S O 1	P S O 2	P S O 3
CO1	3	2	2	1	1	1	0	0	0	2	1	1	3	2	2
CO2	2	3	2	2	2	0	0	0	0	1	2	2	2	3	2
CO3	2	3	3	3	3	1	0	0	1	2	1	2	2	3	3
CO4	3	2	3	3	3	1	1	1	1	2	1	3	3	2	3