



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Electronics and Communication Engineering

Subject Code : DI04011021

Subject Name : Optical Communication

w. e. f. Academic Year:	2025-26
Semester:	4 th
Category of the Course:	Professional Elective - I

Prerequisite:	-
Rationale:	Fiber Optics Communication is an essential component of the modern Telecom Industry. Therefore, it is desired that the diploma engineering students should be able to operate and maintain the components and equipment used in Optical Communication system.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Analyze optical fiber,	
02	Install fiber optic cables,	
03	Test optical driver and receiver circuits,	
04	Identify optical components,	
05	Measure optical fiber parameters in optical network.	

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR		C	Theory		Tutorial / Practical	
			ESE (E)		PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150



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Course Content:

Unit No.	Content	No. of Hours	% of Weightage
	Optical Fiber Waveguide		
1.	1.1 Optical fiber waveguide: 1.1.1 Ray propagation in step index fiber, 1.1.2 Numerical Aperture and acceptance angle, 1.1.3 Skew rays and Meridional rays, 1.1.4 Optical signal as a EM wave with mode concept, 1.1.5 V-number & normalized frequency. 1.2 Types of Optical Fiber: 1.2.1 Step Index and Graded Index, 1.2.2 Single Mode and Multi-Mode, 1.2.3 Cut off wavelength. 1.3 Attenuation: 1.3.1 Absorption losses: intrinsic and extrinsic, 1.3.2 Linear scattering losses: Rayleigh and Mie, 1.3.3 Fiber bend losses: micro and macro. 1.4 Dispersion: 1.4.1 Intermodal Dispersion in Multi-mode Step Index fiber, 1.4.2 Intra-modal (Chromatic) Dispersion: material and Wave guide dispersion, 1.5 General configuration of Fiber optic communication system.	10	24%
	Optical Fiber: Cables & Connections		
2.	2.1 Fiber Fabrication: 2.1.1 Fiber Materials, 2.1.2 Double crucible method. 2.1.3 Vapor deposition methods: MCVD, VAD, 2.1.4 Fiber drawing process. 2.2 Fiber Optic Cables: 2.2.1 Needs of cabling. 2.2.2 Fiber Cables: Slotted core, loose tube and multi-fiber ribbon. 2.3 Connection losses:	10	24%



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	<p>2.3.1 Extrinsic Parameters: Fresnel reflection, Misalignment, and other factors,</p> <p>2.3.2 Intrinsic Parameters: NA mismatch, diameter mismatch,</p> <p>2.3.3 Fiber end preparation for loss minimization.</p> <p>2.4 Splices:</p> <p>2.4.1 Fusions Splices,</p> <p>2.4.2 Mechanical splices: Capillary, V-grooved, Loose tube, spring groove and elastomeric splices.</p> <p>2.5 Fiber optic connector's types as per TIA, IEC and ANSI standards.</p> <p>2.6 SOP for Fiber cable laying.</p>		
	Optical Sources and Detectors		
3.	<p>3.1 Basic concepts of Absorption and Emission in semiconductor.</p> <p>3.2 Characteristic of ideal optical source.</p> <p>3.3 Construction and Operating Principle of LED.</p> <p>3.4 Concept of Heterojunctions LED structure:</p> <p>3.4.1 SLED,</p> <p>3.4.2 EELED.</p> <p>3.5 Construction and Operating Principles of Semiconductor LASER Diode.</p> <p>3.6 Quantum efficiency and Responsivity.</p> <p>3.7 Photo diodes</p> <p>3.7.1 p-n photodiode,</p> <p>3.7.2 p-i-n photodiode,</p> <p>3.7.3 Avalanche photodiode.</p> <p>3.8 Coupling between fiber and Source/ detector:</p> <p>3.8.1 Source to fiber,</p> <p>3.8.2 Fiber to detector.</p> <p>3.9 LED driver circuit (digital)</p> <p>3.10 LASER driver circuit (digital).</p> <p>3.11 Optical receiver block diagram.</p> <p>3.12 Regenerative repeater.</p>	12	29%
	Optical Components		
4.	<p>4.1 Optical components: types and functions:</p> <p>4.1.1 Optical Coupler,</p>	6	14%



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	4.1.2 Optical switches, 4.1.3 Beam splitter, 4.1.4 Optical multiplexer and demultiplexer. 4.1.5 Optical wavelength converter. 4.1.6 Isolators. 4.2 Concept of Bragg grating. 4.3 Optical Amplifiers: 4.3.1 Semiconductor Optical Amplifiers, 4.3.2 EDFA, 4.4 Raman amplifier.		
	Optical parameter measurement and applications of WDM		
5.	5.1 Fiber parameters measurement: 5.1.1 Attenuation, 5.1.2 Numerical Aperture, 5.1.3 Inter modal dispersion, 5.1.4 Refractive Index profile. 5.2 Optical power meter. 5.3 Optical time domain reflectometer. 5.4 WDM & DWDM. 5.5 SONET/SDH, FDDI, FTTP. 5.6 E-waste Management of Optical waste.	7	14%
	Total	45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
45	14	11	NA	NA	NA

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)



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References/Suggested Learning Resources:

(a) Books:

S. No.	Title of Book	Author Publication with place,	Year and ISBN
1	Optical Fiber Communication	John M Senior.	8th, 2014.
2	Fiber Optic Communication	D C Agarwal.	2004.
3	Optical Fiber Communication	Gerd Keiser.	5th, 2017.
4	Fiber Optics & Optoelectronics	R P Khar.	10th, 2010.
5	Fiber Optic Essentials	Casimer M. DeCusatis, Carolyn J. Sher DeCusatis.	1st, 2010.

(b) Open source software and website:

- <http://computer.howstuffworks.com/fiber-optic.htm>
- <http://www.ntu.edu.sg/library/Pages/default.aspx>
- <http://nptel.iitm.ac.in/courses/askaquestion.php?subjectId=117101002>
- <http://www.thefoa.org/tech/>
- <https://cleerlinefiber.com/2020/05/01/fiber-optic-color-codes/>
- http://www.thefoa.org/fo_urls.htm http://en.wikipedia.org/wiki/Optical_fiber
- <http://www.telecomramblings.com/network-maps/usa-fiber-backbone-map-resources/>
- http://www.foci.com.tw/pd_scw.html
- <https://www.tescaglobal.com/blog/fiber-optics-trainer-kit-uses-types-manufacturers/>
- <http://nptel.iitm.ac.in/courses/117101002/>
- <http://www.youtube.com/watch?v=aqazAcE19vw>
- <http://www.youtube.com/watch?v=pIlBINW7sOo>
- <http://www.youtube.com/watch?v=ASMcrcgZSrw>
- http://www.youtube.com/watch?v=llI8Mf_faVo
- <http://fiberu.org/basic/LP3.html>
- <https://www.otelco.com/resources/a-guide-to-fiber-optic-internet/>
- <https://www.google.com/search?q=fiber+splicer&sxsrf=AJOqlzWYYhYksPjuZgwgJoKdk1yYqqRkOQ:1678157453026&source=lnms&tbm=vid&sa=X&ved=2ahUKEwjv>



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ate=ive&vld=cid:1f89feda,vid:xba2MThR9Ls

- <https://vitextech.com/fiber-connector-types/>
- <https://www.youtube.com/watch?v=rA7vUo9m9WY>

Suggested Course Practical List: If any

1	Measure N.A. of optical fiber.	1,5	2*
2	Establish Analog communication optical link.	1,3	2*
3	Establish Digital communication optical link.	1,3	2*
4	Measure attenuation or propagation loss of given optical fiber.	1,5	2*
5	Measure bending loss of given optical fiber.	1	2*
6	Build fiber optics link using TDM technique.	1	2*
7	Demonstrate various fiber cables.	2	2*
8	Demonstrate fiber splicing process.	2	2*
9	Demonstrate types of optical fiber connectors.	2	2*
10	Plot characteristics of LED.	3	2
11	Plot characteristics of LASER diode.	3	2*
12	Plot characteristics of Photo Diode.	3	2*
13	Build and test LED drive circuits.	3	2*
14	Study the Optical Coupler, Switch, and beam splitter.	4	2*
15	Demonstrate OTDR.	5	2*
16	Demonstration of FDDI.	5	2*
17	Demonstration of FTTP.	5	2*

List of Laboratory/Learning Resources Required:

Suggested Project List:

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-projects are group-based (group of 3 to 5). However, **in the fifth and sixth semesters**, the number of students in the group should **not exceed three**.



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The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The duration of the micro project should be about **14-16 (fourteen to sixteen) student engagement hours** during the course. The students ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

- a) Build and test fiber optic link.
- b) Build and test LED driver circuit.
- c) Build and test LASER diode driver circuit.
- d) Build and test repeater circuit.
- e) Identify E-Waste of Optical fiber cable, optical communication and Prepare a brief Report of Remedies for it.

Suggested Activities for Students: If any

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should perform following activities in group and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews:

- i. Read and note down specifications of Optical fiber: Optical fiber mode, types. Application of single mode fiber, and multi-mode fiber, Splicing Technology, Use of Connectors, Couplers, Laser, LED, pn photo diode, p-i-n photo diode, Avalanche photodiode, Bragg grating, SONET, SDH, FDDI, and FTTP.
- ii. Solve real life problems using optical fiber communication.
- iii. Explore working of SONET/SDH, FDDI and FTTP.

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