Lok Jagruti Kendra University
University with a Difference

Diploma in Electronics & Communication Engineering

LJ Polytechnic

Course Code:025030403

Fiber Optic Communication

Programme / Branch Name			Diploma in Electronics and Communication Engineering			
Course Name	Fiber Optic Communication				**Course Code**	025030403
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends: HSSC: Humanities and Social Sciences Courses BSC: Basic Science Courses
ESC: Engineering Science Courses PCC: Program Core Courses
OEC: Open Elective Courses PEC: Program Elective Courses

1) Teaching and Evaluation Scheme

Teaching Hours / Week / Credits				**Evaluation Scheme**			
L	**T**	**P**	**Total Credit**	**CCE**	**SEE (Th)**	**SEE (Pr)**	**Total**
3	0	2	4	50	50	50	150

Legends:
L: Lectures T: Tutorial P: Practical
CCE: Continuous & Comprehensive Evaluation
SEE (Th): Semester End Evaluation (Theory)
SEE (Pr): Semester End Evaluation (Practical)

2) Prerequisite

- ✓ Light propagation in optical fiber.
- ✓ Optical fiber cables and connectors.
- ✓ Concepts of fiber optic communication system.

3) Rationale

Fiber optic is one of the most important technologies that use light. Fiber optic cables transfer the information from one end to another. One end of the fiber connects to a LED or laser that transmits information; the other end is connected to a device designed to recognize the incoming light. Therefore it is desired that the diploma engineering students should be able to operate and maintain the components used in fiber optic communication system.

4) Objectives

- ✓ Analyze optical fiber.
- ✓ Install fiber optic cables
- ✓ Test optical driver and receiver circuits
- ✓ Identify optical components
- ✓ Measure optical fiber parameters
- ✓ Understand, compute and simulate the modes in step index fiber and graded index fiber.

5) Contents

Unit No.	Topics	Sub-Topics	Learning Outcomes	% Weightage	Hours
1	**Optical Fiber Waveguides**	1.1. Describe Total Internal Reflection and Numerical Aperture 1.2. Classification of Optical Fiber 1.3. Fiber Optic Communication System and Its Advantages & Disadvantages	• Laws of Optics: Reflection, Refraction, Snell's Law, Critical Angle, Total Internal Reflection • Numerical Aperture and Acceptance Angle • Ray Propagation in Step Index Fiber and Graded Index Fiber • Definition of Skew Rays • SI and GI, SM and MM • Configuration of Fiber Optic Communication System • Advantages & Disadvantages of Fiber Optic Communication System	30%	10
2	**Losses in Optical Fiber**	2.1. Attenuation and Absorption 2.2. Dispersion	• Attenuation: Absorption Losses-Intrinsic and Extrinsic Scattering Losses-Rayleigh and Mie Bending Losses-Micro and Macro • Dispersion: Intermodal Dispersion Intra-Modal Dispersion • Core and Cladding Losses	10%	06
3	**Fiber Cables & Connectors**	3.1. Optical Fiber Fabrication and Cabling Techniques 3.2. Splicing and Joining of Fiber Cable	• Fiber Fabrication: Fiber Materials, Fabrication Process-Fiber Drawing Process, Vapor Deposition Method (VAD & MCVD) • Fiber Cables: Slotted Core, Loose Tube and Multi-Fiber Ribbon • Splices: Fusion Splices & Mechanical Splices	20%	08

			• Connection Losses: Extrinsic Parameter- Fresnel Reflection, Misalignment Internal Parameter- Intrinsic Parameter- NA Mismatch, Core Diameter Mismatch		
4	**Optical Components**	4.1. Optical Sources and Optical Detectors 4.2. Optical Couplers 4.3. Various Other Optical Components	• LED and LASER • P-N Photo Diode, PIN Photodiode • Function and Types of Optical Coupler • Coupling between Optical Sources/Detectors • Optical Switches and Beam Splitter • Optical Multiplexer and Demultiplexers • Optical Wavelength Converter • Optical Amplifiers	30%	12
5	**Optical Fiber Measurements**	5.1. Measure Optical Fiber Parameters 5.2. Working Principle of Optical Power Meter & OTDR mapping 5.3. Optical Sensors	• Measurements of: Attenuation, NA Dispersion, Refractive Index Profile • Optical Power Meter and Optical Time Domain Reflectometer • Introduction and Classification of Optical Fiber	10%	06
			Total Hours		42

6) List of Practical / Exercises

The practical/exercises should be properly designed and implemented in an attempt to develop different types of skills that students can acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

Sr. No	Practicals / Exercises	Key Competency	Hours
1	Study and measurement of N.A. of optical fiber	Optical Fiber Kit	2
2	Study and measurement of attenuation of given optical fiber	Simulator	2
3	Study and measurement of bending loss of given optical fiber	Simulator	2
4	Demonstrate various fiber cables	Optical Fiber Kit	2
5	Study of splicing techniques		2
6	Demonstrate various connectors	Optical Fiber Kit	2
7	Plot characteristics of LED	Optical Fiber Kit	2
8	Plot characteristics of LASER diode	Optical Fiber Kit	2
9	Plot characteristics of Photo Diode	Optical Fiber Kit	2
10	Plot characteristics of PIN Photo Diode	Optical Fiber Kit	2
11	Establish Analog communication optical link	Optical Fiber Kit	2
12	Establish Digital communication optical link	Optical Fiber Kit	2
		Total Hours	24

7) Suggested Specification Table with Hours

Unit No.	Chapter Name	Teaching Hours	Distribution of Topics According to Bloom's Taxonomy					
			R %	U %	App %	C %	E %	An %
1	Optical Fiber Waveguides	10	40	30	10	0	10	10
2	Losses in Optical Fiber	6	30	20	20	10	10	10
3	Fiber Cables & Connectors	8	20	20	30	20	5	5
4	Optical Components	12	20	30	20	20	5	5
5	Optical Fiber Measurements	6	20	20	30	10	10	10

Legends: R-Remembering C- Creating
U- Understanding E- Evaluating
App- Applying An- Analyzing

8) Textbook

1) John M. Senior, “Optical Fiber Communications: Principle and Practice”, 3rd Ed., Pearson Education.

9) Reference Books

1) Gerd Keiser, “Optical Fiber Communications”, McGraw-Hill Education.
2) P Chakrabarti, “Optical Fiber Communication”, McGraw-Hill Education.
3) D C Agarwal, “Fiber Optic Communication”, S Chand.

10) Open Sources (Website, Video, Movie)

1) https://www.elprocus.com/basic-elements-of-fiber-optic-communication-system-and-its-working/
2) https://computer.howstuffworks.com/fiber-optic.htm