Optical Fiber Communication Syllabus

UNIT I

Introduction

1.1 Historical perspective, Basic Communication Systems, Optical Communication, Electromagnetic Spectrum, Optical Fiber Communication, its advantages, disadvantages and applications.

1.2 Principle of Light Penetration, Reflection, Refraction, Total Internal Reflection (TIR) and Critical Angle.

UNIT II

Optical Fibers and Cables

2.1 Constructional details of Optical Fibers, Multimode and Single-mode Fibers, Step-index and Graded-index Fibers, Acceptance Angle, Numerical Aperture and Types of Optical Fiber Cables.

2.2 Optical Fiber Connectors and Splicing Techniques (Mechanical and Fusion).

2.3 Optical Fiber Cable Losses – Absorption Losses, Scattering Losses, Radiation Losses, Connector Losses and Bending Losses.

2.4 Dispersion in Optical Fibers, Types of Dispersion and its Effect on Data Rate.

UNIT III

Optical Sources

3.1 Principle and Characteristics of Light Emitting Diode (LED) used in Optical Communication.

3.2 Different Types of LED Structures and their Description.

3.3 Principle and Operation of Injection Laser Diode (ILD), Different Injection Laser Diodes and Comparison of LED and ILD.

UNIT IV

Optical Detectors

4.1 Characteristics of Photo Detectors used in Optical Communication.

4.2 PIN Photo Diode – Construction, Principle, Operation and Characteristics.

4.3 Avalanche Photo Diode (APD) – Construction, Principle, Operation and Characteristics.

4.4 Noise in Optical Detectors.

UNIT V

Optical Amplifiers

5.1 Types of Optical Amplifiers.

5.2 Semiconductor Optical Amplifier (SOA) – Principle and Operation.

5.3 Erbium Doped Fiber Amplifier (EDFA) – Principle and Operation.

5.4 Raman Optical Amplifier – Principle and Operation.

5.5 Comparison of SOA, EDFA and Raman Optical Amplifiers

Lesson Plan

Name of Faculty: ___Komal_____

Discipline: Electronics & Communication Engineering

Semester: _____5th Semester_____

Subject: Optical Fiber Communication

Lesson Plan Duration: 16 Weeks

Work Load (Lecture): 3 Hours per Week

Week	Lecture Day	Theory
1st	Day 1	Historical perspective, Basic Communication Systems and Introduction to Optical Communication
	Day 2	Optical Fiber Communication, Advantages, Disadvantages and Applications
	Day 3	Electromagnetic Spectrum and Principle of Light Penetration
2nd	Day 1	Reflection, Refraction, Total Internal Reflection (TIR) and Critical Angle
	Day 2	Constructional Details of Optical Fibers, Core and Cladding
	Day 3	Step-index, Graded-index, Single-mode and Multimode Optical Fibers

3rd	Day 1	Acceptance Angle and Numerical Aperture
	Day 2	Types of Optical Fiber Cables
	Day 3	Optical Fiber Connectors
4th	Day 1	Mechanical and Fusion Splicing Techniques
	Day 2	Optical Fiber Cable Losses – Absorption, Scattering and Radiation Losses
	Day 3	Connector Losses, Bending Losses and Numerical Problems
5th	Day 1	Dispersion in Optical Fibers
	Day 2	Types of Dispersion and its Effect on Data Rate
	Day 3	Revision and Assignment Discussion of Unit II
6th	Day 1	Principle and Characteristics of LED
	Day 2	Types of LED Structures and their Description
	Day 3	Applications of LED in Optical Communication
7th	Day 1	Injection Laser Diode (ILD): Principle and Construction

	Day 2	Operation of Injection Laser Diode and Different Injection Laser Diodes
	Day 3	Comparison of LED and ILD
8th	Day 1	Revision and Numerical Discussion of Unit III
	Day 2	Characteristics of Photo Detectors
	Day 3	PIN Photo Diode – Construction, Principle and Operation
9th	Day 1	Characteristics of PIN Photo Diode
	Day 2	Avalanche Photo Diode (APD): Construction, Principle and Operation
	Day 3	Characteristics of Avalanche Photo Diode (APD)
10th	Day 1	Noise in Optical Detectors
	Day 2	Comparison of PIN Photo Diode and APD
	Day 3	Revision and Assignment Discussion of Unit IV
11th	Day 1	Types of Optical Amplifiers
	Day 2	Semiconductor Optical Amplifier (SOA): Principle and Operation

	Day 3	Erbium Doped Fiber Amplifier (EDFA): Principle and Operation
12th	Day 1	Raman Optical Amplifier: Principle and Operation
	Day 2	Comparison of SOA, EDFA and Raman Optical Amplifiers
	Day 3	Applications of Optical Amplifiers and Unit V Revision
13th	Day 1	Revision of Unit I
	Day 2	Revision of Unit II
	Day 3	Numerical Problems on Units I & II
14th	Day 1	Revision of Unit III
	Day 2	Revision of Unit IV
	Day 3	Numerical Problems on Units III & IV
15th	Day 1	Revision of Unit V
	Day 2	Important University Questions
	Day 3	Doubt Clearing Session
16th	Day 1	Complete Syllabus Revision

	Day 2	Model Question Paper Discussion
	Day 3	Final Revision and Examination Preparation

Practical Syllabus

PRACTICAL EXERCISES (16 Weeks)

1. Identification and use of various components and tools used in Optical Fiber Communication.

2. Set up of Fiber Analog Communication Link.

3. Set up of Optical Digital Communication Link.

4. Measurement of Bending Losses in Optical Fibers.

5. Observation and Measurement of Splice and Connector Losses.

6. Measurement and Calculation of Numerical Aperture (NA) of Optical Fiber.

7. Observation of Characteristics of Optical Sources (LED and Laser Diode).

8. Observation of Characteristics of Optical Detectors (PIN Photodiode and Avalanche Photodiode).

9. Optical Fiber Splicing using Mechanical and Fusion Splicing Techniques.

Practical Lesson Plan

Name of Faculty: _____Komal_____

Discipline: Electronics & Communication Engineering

Semester: _____5th Semester_____

Subject: Optical Fiber Communication Laboratory

Lesson Plan Duration: 16 Weeks

Work Load (Practical): 2 Practical Classes per Week (2 Hours Each)

Week	Practical Class Day	Practical Exercise
1st	Day 1	Introduction to the Optical Fiber Communication Laboratory, laboratory safety and identification of optical fiber communication components and tools.
	Day 2	**Experiment 1:** Identification and use of various components and tools used in Optical Fiber Communication.
2nd	Day 1	Continue **Experiment 1** and record observations.
	Day 2	**Experiment 2:** Set up Fiber Analog Communication Link.
3rd	Day 1	Continue **Experiment 2** and observe analog signal transmission.
	Day 2	**Experiment 3:** Set up Optical Digital Communication Link.
4th	Day 1	Continue **Experiment 3** and analyze digital communication performance.

	Day 2	**Experiment 4:** Measure Bending Losses in Optical Fibers.
5th	Day 1	Continue **Experiment 4** and perform calculations.
	Day 2	**Experiment 5:** Observe and Measure Splice and Connector Losses.
6th	Day 1	Continue **Experiment 5** and compare measured losses.
	Day 2	**Experiment 6:** Measure and Calculate Numerical Aperture (NA) of Optical Fiber.
7th	Day 1	Continue **Experiment 6** with calculations and result verification.
	Day 2	**Experiment 7:** Observe Characteristics of Optical Sources (LED and Laser Diode).
8th	Day 1	Continue **Experiment 7** and record source characteristics.
	Day 2	**Experiment 8:** Observe Characteristics of Optical Detectors (PIN Photodiode and APD).
9th	Day 1	Continue **Experiment 8** and compare detector characteristics.
	Day 2	**Experiment 9:** Optical Fiber Splicing using Mechanical Splicing Technique.

10th	Day 1	Continue **Experiment 9** using Fusion Splicing Technique.
	Day 2	Verification and testing of the spliced optical fiber link.
11th	Day 1	Revision of Experiments 1–3.
	Day 2	Revision of Experiments 4–6.
12th	Day 1	Revision of Experiments 7–9.
	Day 2	Troubleshooting of Optical Fiber Communication experiments.
13th	Day 1	Practical record writing and observation verification.
	Day 2	Viva preparation and demonstration of experiments.
14th	Day 1	Mock Practical Examination – Part I.
	Day 2	Mock Practical Examination – Part II.
15th	Day 1	Practical viva and record verification.
	Day 2	Revision of important practical experiments.
16th	Day 1	End Semester Practical Examination.

	Day 2	Final viva, practical file submission and course completion.