

**University of Management and Technology**

**Course Outline**

**Course code: EE412**

**Course title: Optical Communication**

Program	BS Electrical Engineering
Credit Hours	3
Duration	15 weeks
Prerequisites	Communication Systems
Resource Person	<b>Dr Muhammad Adnan</b>
Counseling Timing	As on website.
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**Chairman/Director signature.....**

**Dean's signature.....**

**Date.....**

## **Learning Objective:**

To understand the principle of EM waves propagation in fiber cables and also about different types of optical fibers. Overview of Optical Networks including PDH, SDH/SONET and DWDM . To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes structures and also about detectors and its performance factors. To learn the fiber optical receivers, noise performance in photo detector, receiver operation and configuration. The various characteristics of signal propagation inside the fiber and its basic geometric parameters measurement techniques are also learnt to design a optical communication system.

## **Learning Methodology:**

Lectures, interactive discussions, formal assessments.

## **Grade Evaluation Criteria**

Following is the criteria for the distribution of marks to evaluate final grade in a semester.

<b>Marks Evaluation</b>	<b>Marks in percentage</b>
Quizzes	15%
Assignments/Graded Labs	10%
Mid Term	25%
Attendance & Class Participation	-
Term Project	-
Presentations	-
Final exam	50%
Total	100%

### **Recommended Text Books:**

Optical Fiber Communications Principle and Practice 3e John M.Senior

### **Reference Books:**

Fiber Optic Communication 3e, Govind P Agarwal.

Optical Fiber Communication 3e, Grid Keiser.

Optical Communication System John Gawar.

## Calendar of Course contents to be covered during semester

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Week	Course Contents	Reference Chapter(s)
1	Introduction – Syllabus overview and Unit overview Ray theory transmission ,Total internal reflection, Acceptance angle –Numerical aperture.	Text Book
2	Skew rays, Electromagnetic mode theory of optical propagation- EM waves – Modes in Planar guide Phase and Group velocity, Cylindrical fibers(Maxwell's equation, Boundary conditions) Modes.Problems	Text Book
3	Cont. Cylindrical fibers-Linearly polarized Modes Mode coupling, Step Index Fiber , Graded Index Fiber Single Mode fibers, Cutoff wavelength.Problems	Text Book
4	Mode Field Diameter, Effective Refractive index, Group delay and mode delay. Gaussian approximation, Equivalent step index methods.Problems	Text Book

5	Attenuation – Material absorption losses in silica glass fibers, Intrinsic absorption, Extrinsic absorption. Linear and Non linear Scattering losses(Rayleigh scattering, Mie scattering, Stimulated Brillouin scattering, Stimulated Raman Scattering).Problems	Text Book
6	Fiber Bend losses – Mid band and far band infra red transmission. Dispersion - Intra Modal Dispersion .Problems	Text Book
7	Inter Modal Dispersion-Multimode step and graded index fiber. Over all Fiber Dispersion-Multimode fiber and single mode fiber. Polarization- Polarization maintaining fibers.Problems.	Text Book
8	<b>Mid Term Exam</b>	
9	Fiber alignment and Joint Losses – Multimode fiber joints	Text Book

10	Introduction to PDH, PDH justification ,SONET /SDH frame format, VCAT .	Text Book
11	Optical sources: Light Emitting Diodes(Introduction, LED power and efficiency). LED structures -surface and edge emitters (mono and hetero structures).	Text Book
12	Internal - quantum efficiency-Derivation, injection laser diode structures (Principle). Injection laser diode (Types). Avalanche photo diodes, construction, characteristics and properties.	Text Book
13	Fundamental receiver operation, Error sources – Receiver Configuration	Text Book
14	Solitons (Pulses, parameters, Width and spacing). Fiber Manufacturing Techniques.	Text Book
15	Free Space Optics, Optical CDMA, Ultra High Capacity Networks (WDM systems, Bit interleaved optical TDM, Time slotted optical TDM)	Text Book