

B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AEC64a- OPTICAL COMMUNICATIONS

(Professional Elective – II)

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Course Objectives: The objectives of the course are to make the students learn about

- To comprehend the basic concepts and functional blocks in optical communications.
- To read and analyze different types of signal distortions and losses in optical communication.
- To gain knowledge on optical sources and coupling.
- To introduce concepts related to photo detectors and fiber optical receivers.
- To learn about the optical systems design and applications.

UNIT – I:

Introduction to Optical Fibers: Evolution of fiber optic system- Element of an Optical Fiber Transmission link- Ray Optics-Optical Fiber Modes and Configurations –Mode theory of Circular Wave guides- Overview of Modes-Key Modal concepts- Linearly Polarized Modes –Single Mode Fibers-Graded Index fiber structure.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the basic concepts of optical communication. L2
- Analyze different optical Fiber modes and configurations. L4

UNIT – II:

Signal Degradation Optical Fibers: Attenuation – Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides - Information Capacity determination – Group Delay- Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers-Mode Coupling –Design Optimization of SM fibers-RI profile and cut-off wavelength.

Learning Outcomes:

At the end of this unit, the student will be able to

- Analyze the losses due to scattering, bending, core and cladding. L4
- Understand different type's dispersion mechanisms. L2

UNIT – III:

Fiber Optical Sources and Coupling : Direct and indirect Band gap materials-LED structures –Light source materials –Quantum efficiency and LED power, Modulation of a LED, lasers Diodes-Modes and Threshold condition –Rate equations –External Quantum efficiency –Resonant frequencies –Temperature effects, Introduction to Quantum laser, source-to-fiber Power Launching, Lensing schemes, Fibre –to- Fibre joints, Fibre splicing.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand different types of light source materials and their structures. L2
- Know about the importance of different types connectors. L1

UNIT – IV:

Fiber Optical Receivers : PIN and APD diodes –Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise –Comparison of Photo detectors –Fundamental Receiver Operation – preamplifiers, Error Sources –Receiver Configuration –Probability of Error – Quantum Limit.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the operation of Photo Detectors. **L2**
- Know about fiber optical receiver operation and various sources of error. **L1**

UNIT – V:

System Design and Applications: Design of Analog Systems: system specification, power budget, bandwidth budget

Design of Digital Systems: system specification, rise time budget, power budget, Receiver sensitivity, Overview of WDM.

Applications: Telephony, Telemetry, video distribution, military applications, passive and active sensing.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the design and specifications of analog and digital systems.(L2) **L1**
- Summarize the applications of optical communications.(L1) **L2**

Text Books:

1. Gerd Keiser, "Optical Fiber Communication", 3rd Edition, McGraw –Hill International, Singapore, 2000.
2. J.Senior, "Optical Fiber Communication, Principles and Practice", 3rd Edition, Pearson Publishers, 2010.

Reference Books:

1. Max Ming-Kang Liu, "Principles and Applications of Optical Communications", 1st Edition, TMH, 2010.
2. S.C.Gupta, "Text book on optical fiber communication and its applications", 2nd Edition, PHI, 2012.

Course Outcomes:

At the end of this Course the student will be able to

- Understand the basic concepts and about the functional blocks in optical communication. **L2**
- Analyze different types of signal distortions and losses in optical communication. **L4**
- Gain the knowledge on optical sources and coupling. **L1**
- Understand the concepts related to photo detectors and fiber optical receivers. **L2**
- Know about the optical systems design and applications. **L1**

