EOPE3005 OPTICAL AND SATELLITE COMMUNICATION (3-0-0)

Course Objectives:

1. To provide fundamental knowledge of optical fiber communication including ray theory, modes of propagation, attenuation, and dispersion characteristics.
2. To familiarize students with different optical sources and detectors and their operational principles and characteristics.
3. To enable learners to understand fiber optic receiver design, measurement techniques, and performance evaluation.
4. To introduce the principles of satellite communication including orbital mechanics, spacecraft subsystems, and link design.
5. To impart knowledge on multiple access techniques, digital and analog transmission methods, and earth station technologies.

Module-I (6 hours)

Introduction: Introduction, Ray theory transmission, Total internal reflection-Acceptance angle, Numerical aperture; Skew rays; Electromagnetic mode theory of optical propagation: EM waves, modes in Planar guide, phase and group velocity; cylindrical fibers, SM fibers. Transmission characteristics of optical fibers: Attenuation – Material absorption losses in silica glass fibers, Linear and Non linear Scattering losses, Fiber Bend losses; Mid band and far band infrared transmission; Intra and inter Modal Dispersion – Over all Fiber Dispersion; Polarization: non linear Phenomena; Optical fiber connectors, Fiber alignment and Joint Losses; Fiber Splices, Fiber connectors, Expanded Beam Connectors : Fiber Couplers.

Module-II (6 hours)

Sources and detectors: Optical sources: Light Emitting Diodes, LED structures, surface and edge emitters, mono and hetero structures: internal; quantum efficiency; injection laser diode structures; comparison of LED and ILD Optical Detectors: PIN Photo detectors, Avalanche photo diodes, construction, characteristics and properties.

Module-III (6 hours)

Fiber optic receiver and measurements: Fundamental receiver operation, Pre amplifiers, Error sources: Receiver Configuration Probability of Error Quantum limit; Fiber Attenuation measurements, Dispersion measurements, Fiber Refractive index profile measurements, Fiber cut- off Wave length Measurements, Fiber Numerical Aperture Measurements, Fiber diameter measurements.

Module-IV (6 hours)

Introduction to state of satellite communication: Orbital mechanics and parameters, look angle determination, Launches and Lunch vehicle, Orbital effects in communication system performance. Attitude and orbit control system(AOCS), TT&C, Description of spacecraft System – Transponders, Equipment reliability and space qualification. Satellite Link Design: Basics of transmission theory, system noise temperature and G/T ratio, Uplink and Downlink design, design of satellite links for specified (C/N) performance.

Module-V (6 hours)

Analog telephone and television transmission: Energy dispersal, digital transmission Multiple Access: Multiplexing techniques for satellite links, Comprehensive study on FDMA, TDMA and CDMA. Spread Spectrum Transmission and Reception. Estimating Channel requirements, SPADE, Random access. Earth station Technology: Earth station design.

Text Books:

1. Optical Fiber Communication, Gerd Keiser, McGraw Hill, Third Edition, 2000.
2. Optical Fiber Communication, John M. Senior, Pearson Education, Second Edition, 2007
3. Satellite Communication by T. Pratt, C. Bostian. 2nd Edition, John Wiley Co.

Reference Books:

1. Optical Communication System, J. Gower, Prentice Hall of India, 2001.
2. Optical Networks, Rajiv Rama swami, Elsevier ,Second Edition, , 2004. 3. Fiber-optic communication systems, Govind P. Agrawal, John Wiley & sons, third edition, , 2004.
3. Fiber Optics and Optoelectronics, R.P. Khare, Oxford University Press, 2007. 4. Optical Communication Network, Viswanath Mukherjee, McGraw Hill Publication,2000