OPTICAL COMMUNICATIONS

PROF. PRADEEP KUMAR K
Department of Electrical and Electronics Engineering
IITK

TYPE OF COURSE : Rerun | Core/Elective | UG
COURSE DURATION : 12 Weeks (18 Jan' 21 - 09 Apr' 21)
EXAM DATE : 24 Apr 2021

PRE-REQUISITES : Knowledge of electromagnetics and digital communication fundamentals

INTENDED AUDIENCE : UG

INDUSTRIES APPLICABLE TO : LIST OF COMPANIES/INDUSTRY THAT WILL RECOGNIZE/VALUE THIS ONLINE COURSE Tejas Networks, Sterlite Technologies, Many defense labs, etc

COURSE OUTLINE :

Optical communications is a frequent elective/core course offered to third/final year undergraduate students in Electrical Engineering. This course offers a gradual approach to optical communications with emphasis on latest developments in coherent optical communications. Starting from a broad introduction to transmitters and receivers, this course covers optical fibers and waveguides, lasers, detectors, optical amplifiers, channel impairments and their mitigation using signal processing algorithms. Matlab models will be discussed.

ABOUT INSTRUCTOR :

Dr. Pradeep Kumar K obtained his PhD from the Department of Electrical Engineering, IIT Madras working on Quantum Key Distribution in 2009. He has since been at the Department of Electrical Engineering, IIT Kanpur. His research interests include Quantum key distribution, coherent optical communications, and nonlinear fiber optics.

COURSE PLAN :

Week 1: Overview of optical fiber communications, Optical transmitter components--lasers and optical modulators

Week 2: General digital communication system, Line coding and Pulse shaping, Signal space representation

Week 3: Digital modulation formats: ASK, PSK, and QAM, Matlab models, Optical implementation, Matlab models

Week 4: Higher-order modulation (star and square QAM) and Multicarrier modulation (OFDM), Optimum receiver principles

Week 5: Optical receivers I: Photodetectors and its performance characteristics, noise in photodetection, common types of photodetectors

Week 6: Optical receivers II: Direct detection, self-homodyne (differential) detection, and coherent detection, Sensitivity, Impact of noise

Week 7: Lasers, rate equations, RIN and phase noise

Week 8: Optical amplifiers: EDFA and SOA, ASE, system impact

Week 9: Electromagnetic theory, Wave equations, Reflection and transmission of waves

Week 10: Optical fiber modes, single and multi-mode fibers, single and multi-core fibers, attenuation and dispersion

Week 11: Nonlinear effects (SPM, XPM, FWM), Multiplexing: Polarization, Wavelength, and Time division multiplexed systems, Important WDM components

Week 12: DSP in optical communications, dispersion mitigation, phase noise estimation and compensation, carrier phase recovery, digital back propagation