PVP-19

FIBER OPTIC SENSORS AND APPLICATIONS

Course Code	19EC4605F	**Year**	III	**Semester**	II
Course Category	Program Elective	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Understand an optical fiber communication link. (L2).
CO2	Analyze the characteristics of LED&LASER sources and Photo detectors (L4).
CO3	Identify the industrial applications of Optical Fibers.(L3)
CO4	Develop an Optical Network (L3).

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3								1		2
CO2	2	3	2	2								2		1
CO3	3	2	3	3								2		2
CO4	2	3	2	3								1		1
Average* (Rounded to nearest integer)	3	3	3	3								2		2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Propagation of EM waves in Optical fibers:** Fiber optic communication system, Light propagation through fibers, Acceptance angle, Numerical Aperture, Types of fibers and their properties - step index, graded index, single mode & multimode, Losses in optical fibers-Absorption, Attenuation, Scattering and Dispersion losses.	CO1
II	**Optical Sources:** LED- Principle of operation, LED materials, power and efficiency calculation, LED structures- Homostructure, Heterostructure, LED types-surface emitting and edge emitting LEDs – and their characteristics. LASER-Fundamental characteristics, three level and four level lasers-Properties of lasers-Laser modes-Resonator configuration, Types of lasers - Gas laser, solid laser, liquid laser, semiconductor laser.	CO2

III	**Photo detectors:** Performance and compatibility requirements for detectors, Optical detection principles, Quantum efficiency, responsivity, noise and gain calculation of detectors, P-i-N photodiodes, Avalanche photodiodes, Quantum-dot photo detectors, Phototransistors.	CO2
IV	**Industrial applications of Optical Fibers and LASERS:** Mach-Zehnder Interferometric sensor, fiber optic gyroscope, distributed fiber optic sensor-OTDR, LIDAR, measurement of pressure, temperature, current and liquid level, Material processing-Laser heating, removal and vaporization. Holography - Basic principle, Holographic interferometer, applications –Holography for non-destructive testing-Medical applications of lasers.	CO3
V	**Fiber Optic networks and IOT** Optical Networking: Network terminology, Network categories, network layers, Network topologies, SONET/SDH-Networks, High-speed light wave links, Building blocks of IOT enabling technologies, characteristics of IOT systems, physical and logical design of IOT, Data acquisition using sensors, camera, GPS, Smart phone.	CO3

Learning Resources

Text Books

1. Optical Fibre Communications Principles and Practice, Third edition John M. Senior, PearsonEducation Limited 2009.
2. Optical Fibre Communications, fourth edition, Gerd Keiser, Tata McGraw Hill EducationPrivate Limited, 2012.
3. Industrial lasers and their applications, John and Harry, McGraw Hill, 1974.
4. Internet of Things: A Hands-On Approach by Arshdeep Bahga, Vijay Madisetti, 2014.

Reference Books

1. Optical electronics foundation book, Ghatak A.K. and Thiagarajan K, TMH, New Delhi,1991.
2. Fibre Optic Communications, Joseph C. Palais, 5th Edition, Pearson Education, 2008.
3. Introduction to lasers and their applications, D.C.O'shea, Russel Callen, Mc Millan, 1977.
4. Industrial applications of lasers, John F Ready, Academic press, 1978.

e- Resources & other digital material

1. https://onlinecourses.nptel.ac.in/noc21_ee40/preview
