

Course Type	Course Code	Name of Course	L	T	P	Credit
OE	ECO402	Fiber Optic Sensors	3	0	0	9

Course Objective
The objective of the course is to provide an introduction to the optics sensors, which has wide industrial applications where the environment is harsh and explosive such as mining, geophysics, and petrochemical industries.
Learning Outcomes
Upon successful completion of this course, students will: - Understand the benefits of fiber optic sensors (FOS) - know the basic principles upon which FOS rely - familiar with various physical, environmental, chemical, and biomedical parameters that can be measured using FOS - understand how this technology is being used and how it is likely to impact future systems.

Unit No.	Topics to be Covered	Lectu Hours	Learning Outcome
1.	Introduction to Fiber Optic Sensors (FOS), advantages and classification	2	Definition and compression of FOS with conventional sensors their advantages and classification
2.	Intensity-modulated FOS: Introduction, Modulation Schemes, External modulated Sensors (Extrinsic): Transmittive mode, Reflective mode, Refractometer and Absorption based sensors. Internal Modulated Sensors (Intrinsic): Micro-bend pressure and displacement. Evanescent wave coupling Sensors: Methane gas, Temperature, Liquid level. Reflective Index modulation based Sensor.	8	This gives the concept of intensity modulation, intrinsic, extrinsic, and evanescent wave FOS.
3.	Phase Modulated FOS: Introduction, Configurations, Michelson Interferometer, Mach-Zehnder Interferometer, Febry-Perot Interferometer, FO Rotation Sensors (Gyroscope: Open loop and closed loop Gyros).	8	It provides the concept of most sensitive phase-modulated FOS with particular emphasis on MZI, FPI, and Gyroscopes
4.	Polarization based FOS: Current Sensor.	2	Gives the concept of high power FO current sensor
5.	Fiber Bragg Grating (FBG): Introduction, Fabrication techniques, FBG devices and FBG sensors (Temp, Strain, and other applications)	6	It provides the concept of short and long period FBGs and their various uses.
6.	Introduction to Photonics Crystal Fibers (PCF); Holey Micro-structured Fibers, Photonic Band Gap Fibers, Surface plasmon based sensors, Plastic-Clad Silica (PCS) Fibers and their application to sensors.	6	Students will be exposed to photonic crystal fibers and holey fibers, awareness for microwave photonics and their applications.
7.	Industrial Applications of Fiber Optic Sensors: Environmental monitoring Mining, Mineral, Petroleum, Railway, Medical Industries,	10	Applications of FOS for hazardous and explosive gases, temperature, air velocity, humidity sensors.
Total number of classes: = 42			

Textbook:

- Optical fiber sensing and signal processing, B. Culshaw, Peter Peregrinus Ltd (1986)
- Fundamentals of fiber optics in communication and sensor systems. Ed. B. Paul, Wiley Eastern Ltd (1994).

Reference Books:

- Fiber optic sensors: An introduction for Engineering Scientists Ed. Eric Udd, Wiley-International (1991).
- Fiber Optic Sensors: Hendrik.