Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NECD533	Nonlinear Optics	3	0	0	3

Course Objective

This course provide a comprehensive account of the nonlinear phenomena in optical fibers. The mathematical tools needed for understanding the various nonlinear effects and their applications for devices and system will be detailed in the course.

Learning Outcomes

At the end of the course, the student must be able to

- Understand basic principles of nonlinear optics
- Understand the various nonlinearities in the context of optical fibers including SPM, XPM,FWM etc.
- Analyze the applications of fiber nonlinearities in photonic devices

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Introduction, fiber characteristics, fiber nonlinearities. Pulse propagation in fibers, Maxwell's equations, fiber modes, nonlinear-Schrödinger equation (NLSE), variational and numerical methods to solve NLSE.	10	Acquire an understanding of fiber nonlinearities and develop the required mathematical tools
2	Group velocity dispersion, dispersion-induced pulse broadening, third-order dispersion, dispersion management.	08	Develop an understanding about dispersion effects
3	Self-phase modulation, SPM-induced spectral broadening, and effect of group-velocity dispersion.	07	Understand the effects of SPM and GVD on propagation in optical fibers
4	Optical solitons, modulation instability, fiber solitons, perturbation of solitons, higher-order effects	06	Obtain the knowledge of optical solitons
5	Cross phase modulation, XPM-induced nonlinear coupling, XPM-induced modulation instability, spectral and temporal effects, applications of XPM, FWM and its effects.	11	Understand the concept and applications of nonlinear effects like XPM, FWM etc.
	Total	**42**	

Textbook:

1. Nonlinear Fiber Optics, G. P. Agrawal, Academic Press, 2012

Reference Books:

1. R.W.Boyd, Nonlinear Optics, Academic press,2007.
2. G.P.Agrawal, Applications of Nonlinear Fiber Optics, Academic Press, 2001.