



**FIRST SEMESTER 2023-2024**

**Course Handout Part II**

Date: 04-08-2023

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

*Course No.* : EEE G591  
*Course Title* : Optical Communication  
*Instructor-in-Charge* : Dr. Subhradeep Pal

**Scope and Objective of the Course:**

Basic concepts of optical Communication systems, linear and non-linear optical fiber characteristics, optical sources and transmitters (design, performance), modulator (direct/indirect), optical coupling/distribution, optical amplifiers, coherent lightwave system, long-haul and distribution optical communication systems, WDM & TDM lightwave system, and new advances in optical communication.

**Textbooks:**

1. G. P. Agarwal, "Fiber Optic Communication Systems," 3<sup>rd</sup> Ed., John Wiley and Sons, 2002.

**Reference books**

1. G. Kaiser, "Optical Fiber Communications," 5<sup>th</sup> Ed., McGraw Hill Education, 2013.
2. Rajiv Ramaswami, Kumar N. Sivarajan, and Galen H. Sasaki, "Optical Networks – A Practical Perspective," 3<sup>rd</sup> Edition, Morgan Kaufmann, 2010.

**Course Plan:**

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1	Introduction; Concept of field propagation in optical fibers	Optical Confinement, cutoff condition, single mode/multimode concept, V- number, mode	1, 2
2	Concept of field absorption, scattering, loss	Impairments in optical fibers	2 (T)
3	Concept of pulse broadening and bandwidth limitation	Dispersion in fibers	2(T)
4	Concept of dispersion reduction and B.L optimization.	Zero dispersion concepts, DSF, DFF	Ch.3 (R2)



Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
5	Nonlinear effects in optical fibers	SRS, SBS, SPM, XPM, FWM	12 (R2)
6	Pulse evolution through fiber	Detailed analysis of split-step Fourier method	1
7	Concepts of dispersion compensation	Dispersion management, FWM Tech.	3 (R2)
8-10	Concept of semiconductor sources, optical gain, high speed semiconductor lasers	LED & ILD, Laser modes, laser action, mode selection, Chirping control, mode selection	5.3 (R1), 3 (T) Class, 3(T) Class, 6.6 (R2)
11-14	Concept of Electro-Optic effect/ acousto-optic effect	Pockel effect & Kerr effect based devices, Raman & Bragg modulators, deflectors	17 (R3)
15-18	Concepts of Transmitter design and performance metrics and issues	Industry standard lightwave transmitters, coherent lightwave transmitters, Reliability, Testing, chirping and performance study	Class notes
19-23	Concept of photodetection, optical receiver design and analysis	PIN, APD, MSM photodetectors, Receiver design, S/N Estimation, Digital optical receivers, Sensitivity analysis, BER optimizations	Class notes
24-26	Concept of optical amplifiers	SLA, SRA, SBS, EDFA, YDFA	6(T)
27-29	Concept of design Power penalty	Power penalty estimation and reduction approaches, link budget, rise-time budget	5.4 (T)
30-31	Concept and design guidelines for optical link	Power penalty considerations and link budget.	5.4 (T)
32-34	Concept of optical networks and system architectures, networking algorithms	Different topologies used in optical networks, Optical LAN, WANS, SONET/SDH, some key networking algorithms	8 (R1),6(R3)
35-38	Concept of Optical Networks	Channel spacing decision, multipliers, design issues, Practical Transmitters /Receivers, Linear and Nonlinear effects, Optical TDM techniques	8 (R1),6(R3)
39-40	New Concepts	DSP in Optical Communications	Class Notes

### Evaluation Scheme:

Component	Duration	Weightage (%)	Marks	Date & Time	Nature of Component
Quizzes	30 mins.	10%	30	To be announced	Open Book
Mid-Sem	90 mins.	20%	60	To be announced	Closed Book
Regular labs	--	30%	90	--	Open Book
Comprehensive Exam	3 hours	40%	120	To be announced	Closed Book



**Chamber Consultation Hour:** To be announced in lecture class

**Notices:** Through CMS only.

**Make-up Policy:** The course will be conducted through **a zero make-up policy** for regular lab sessions and quizzes. Make-up for comprehensive and mid-term examination will be given for extremely genuine cases (only medical ground) for which prior permission of the IC has to be taken.

**Academic Honesty and Integrity Policy:**

Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**Dr. Subhradeep Pal**  
**INSTRUCTOR-IN-CHARGE**

