

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI, HYDERABAD CAMPUS
INSTRUCTION DIVISION, FIRST SEMESTER 2016-2017
Course Handout (Part-II)

Date: 23/07/2016

Course No. : EEE G591

Course Title : Optical Communication

Instructor-in-charge : Mr. Balasubramanian M

Course Description:

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

Scope and objective of the course:

This course is intended for a specialized degree of communication engineering/Science students at senior levels. This course covers a detailed discussion on optical communication concepts, components, system and applications. The goal of this course is to enhance the basics and concepts of optical communication system design

1. Text Book :

Govind P. Agrawal, "Fiber-optic Communication Systems" Third Edition, John Wiley 2002.

2. Reference Books :

- i) RB1: John Powers, "An Introduction to Fiber Optic Systems" 2nd Ed., IRWIN, 1997
- ii) RB2: Robert M. Gaglindi & S. Karp, "Optical Communications" John Wiley & Sons NC, 1995.
- iii) RB3: Rajiv Ramaswami, Kumar N. Sivarajan, "Optical Networks-A Practical Perspective", Morgan Kaufmann Pub. Second Ed., 2004
- iv) RB4: Djafar K. Mynbaev & Lowell L Scheiner "Fiber – Optic Communications" Person Asia, First Indian Reprint, 2001.

3. Course Plan:

L No.	Learning Objective	Topic to be Covered	Ref*.Chap/ Sec./ (Book)
1.	Concept of field propagation in optical fibres	Optical Confinement, cutoff condition, single mode/multimode concept.	2(T)
2.	Concept of field absorption, scattering, loss	Fiber loss, linear scattering	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	Class discussions Ch.3 (R2)

5.	Nonlinear effects in optical fibers	SRS,SBS,SPM,XPM,FWM	Class, 3.4 (R1)
6.	Concepts of dispersion compensation	Dispersion management, FWM Tech.	3.3 (R2)
7.	Concept of semiconductor sources	LED & ILD	5.3 (R1), 3 (T)
8.	Concepts of optical gain	Laser modes, laser action, mode selection	3(T),9.2 (R4)
9.	Concept of high speed S.C lasers	Chirping control, mode selection	Class, 6.6 (R2)
10.	Concept of Electro-Optic effect	Pockel effect & Kerr effect based devices	17 (R3)
11.	Concept of Acousto-Optic effect	Raman & Bragg modulators, deflectors	17 (R3)
12.	Concepts of Transmitter design.	Coherent light wave Transmitters	Class, 10 (R4)
13.	Concept of performance issues of transmitters	Reliability, Testing, chirping and performance study	Class notes
14.	Concept of photo detection	PIN,APD, MSM.	6(R1),4(T)
15.	Concept of optical receiver	Receiver design, S/N Estimation, Digital optical receivers	10(T) Class
16.	---Do---	Digital receiver sensitivity (Coherent receivers)	6.3-6.4(R1) 10(T)
17.	Concept of receivers performance	Design issues, S/N and BER optimization.	10(T),6.4, 6.5 (R1)
18.	Concept of receivers overview	Practical receiver discussion	Class,11 (R4),10(T)
19.	Concept of Semiconductor laser amplifier	SLA,	6(T)
20.	Concept of active fibre amplifiers	SRA, SBS	6(T)
21.	Concepts of Doped fibre amplifiers	EDFA	6(T), Class notes
22.	Concept of light wave amplifier systems.	Design and application of amplifiers	Ch.6 (T)
23.	Concept of light wave communication systems	Design issues of communication systems	Class
24.	Concept of design Power penalty	Power penalty estimation and reduction approaches.	5.4 (T)
25.	Concept and design guide-lines for optical link	Power penalty considerations and link budget.	5.4 (T)
26.	Concept of optical network and system architectures	Different topologies used in optical network	8 (R1),6(R3)
27.	Concept of Optical Networks	Optical LAN , WANS, SONET/SDH	8 (R1),6(R3)
28.	Concept WDM light wave system	Channel spacing decision, multipliers, design issues	8(T)
29.	Concept of WDM system components	couplers/routers/switches	8(T)
30.	--Do --	Optical filters	Class, (T) 13 (R4)
31.	Concepts of WDM	Practical Transmitters	Class,12.2 (R4)

	Transmitters/Receivers	/Receivers	
32.	Concept of WDM system performance	Linear and Nonlinear effects	8(T)
3335	Concepts of WDM Networking	WDM Network routing/management	8(R3)
36	Concept of time division multiplying	Optical TDM techniques.	7.4 (R1)
37	Concept of soliton communication	Soliton Generation	19 (R2), 9(T) 7.10 (T)
38	--Do--	Soliton Interaction	9(T)
39	--Do--	High capacity soliton systems and jitter reduction	9(T)
40	Concept of WDM soliton system	Soliton Multiplexing techniques	Class notes
41	To learn new development in optical communication	New trends in optical communication	R3,Class notes
42	-----Do-----	Networking, communication	R3,Class notes

4. Evaluation Scheme:

Component	Duration	Percentage	Marks	Date & Time	Evaluation type
Test-I	60 min	15%	45	10/9, 1.00-2.00 PM	Closed Book
Test-II	60 min	15%	45	22/10, 1.00-2.00 PM	Closed Book
Regular Labs		20%	60		Open Book
Project		20%	60	-----	Open Book
Compre. Exam.	3 hours	30%	90	01/12 FN	Closed Book
Total			300		

5. Chamber Consultation Hour: To be announced in the class
email: balasubramanian@hyderabad.bits-pilani.ac.in

6. **Notices:** EEE Notice Board and CMS.

7. Make-up Examination:

No make-up will be given for *Assignment* and Surprise tests. However for Tests and Comprehensive Examination make-up examination will be given only in **extremely genuine cases** for which prior permission of the instructor-in-charge is required.

Instructor-in-charge
EEE G591