MERI College of Engineering and Technology

Asanda, Near Sampla

(www.meri.edu.in/engineering)

LESSON PLAN

Name if the faculty : Er. Gaurav Kumar

Discipline : Electronics & Communication Engineering

Semester : 7th

Subject : Data Communication

Lesson Plan Duration : 15 weeks (From August, 2018 to November 2018)

Work Load (Lecture/ Practical) per week (in hours): Lecture-04, Practical-02

Week	Theory		Practical	
	Lecture day	**Topic(Including assignment/test)**	**Practical Day**	**Topic**
1st	1st	Elements of fiber communication link	1st	NO LAB WITH THIS SUBJECT
	2nd	Advantage of Data fiber communication		
	3rd	Ray theory and electromagnetic mode theory for Data propagation		
	4th	**Revision and assignment**		
2nd	1st	Step index and graded index fibers	2nd	
	2nd	Numerical Aperture		
	3rd	Attenuation, Absorption		
	4th	**Revision and assignment**		
3rd	1st	Dispersion, overall fiber dispersion	3rd	

	2nd	Polarization, fiber bending losses		
	3rd	Multimode step index and graded index fibers		
	4th	**Revision and assignment**		
4th	1st	Data fiber cables,	4th	
	2nd	Dispersion shifted		
	3rd	Dispersion flattered fibers		
	4th	**Revision and assignment**		
5th	1st	Basic concepts: LED for Data Communication	5th	
	2nd	Burrus type double hetro-structure LED		
	3rd	LED Shape Geometry		
	4th	**Revision and assignment**		
6th	1st	LED to fiber launch systems semiconductor Lasers Theory	6th	
	2nd	Modulation and Characteristics		
	3rd	Fabry-Perot lasers quantum well lasers		
	4th	**Revision and assignment**		
7th	1st	P.I.N Photo Diodes: Theory and their characteristics	**7th**	
	2nd	Theory of Avalanche photo diode detectors		
	3rd	Band width noise in APD		
	4th	**Revision and assignment**		
8th	1st	LED and laser drive circuits	8th	
	2nd	Structure of Data receiver circuit		
	3rd	Pre amplifier, AGC, Equalization		
	4th	**Revision and assignment**		

9th	1st	Analog systems : analog modulation	9th	
	2nd	Direct modulation		
	3rd	Sub carrier modulation		
	4th	Distribution system		
10th	1st	Data TDM sub-carrier multiplexing	10th	
	2nd	WDM (Wavelength Division Multiplexing)		
	3rd	Coherent receiver		
	4th	Homodyne and heterodyne detection		
11th	1st	Noise in coherent receiver	11th	
	2nd	Polarization Control		
	3rd	Homodyne receiver		
	4th	**Revision and assignment**		
12th	1st	Heterodyne receiver	12th	
	2nd	Synchronous Modulation and Demodulation		
	3rd	Asynchronous Modulation and Demodulation		
	4th	**Revision and assignment**		
13th		Linear and non-linear scattering losses		
		Single mode fiber, plastic clad and all- plastic fibers		
		Practical fiber profiles Reusability and laser line-width		

		Revision and assignment		
14th		Edge emitting LED		
		Distributed feedback Lasers		
		Data transmitter circuit		
		Revision and assignment		
15th		Data power budgeting line loading		
		Phase diversity receivers		
		Self-synchronous Modulation and Demodulation		
		Revision and assignment		

Session - 2018   Semester: 2nd
Name of the Faculty: Dr. Umesh Gupta
Subject & Code: Data Communication (MEEC-504)   L (3) T (1) P (0)

ASSIGNMENT-1

1. What are the Elements of fiber communication link? Explain with help of suitable diagram.

2. Explain the concept of the Ray theory. Also explain the Electromagnetic mode theory for Data propagation.

3. Compare waveguide and Data fibers from the point of view frequency limitation, attenuation, spurious radiation and power handling capacity.

4. What are different types of Data Fibers? Explain the Step index and graded Index fibers in detail.

5. Explain the concept of electromagnetic modes in relation to a planar Data waveguides. Discuss the modifications that may be made to electromagnetic mode theory in a planar waveguide in order to describe Data propagation in a cylindrical fiber.

6. A multimode graded index fiber has an acceptance angle in air of 8 degree. Estimate the relative refractive index difference b/w the core axis and the cladding when the refractive index at the core axis is 1.52.

7. What are the main advantages of using Data fibers for purpose of Data communication?

8. What is acceptance angle? Also calculate the value of Numerical Aperture for standard fiber.

9. A typical relative refractive index difference of an Data fiber designed for long distance transmission is 1%. Estimate the NA and solid acceptance angle in air for the fiber when the core index is 1.46. Further calculate the critical angle at the core-cladding interface within the fiber. It may be assumed that concept of geometric optics holds for the fiber.

10. What are the Skew Rays? Explain.

Session - 2018   Semester: 2nd
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ASSIGNMENT – 2.

1. Discuss absorption losses in Data fibers comparing and contrasting the intrinsic and extrinsic absorption mechanism.

2. Explain what is meant by the critical bending radius for an Data fiber? A single made step index fiber has a critical bending radius of 2 nm when illuminated with light at a wavelength of 1.30 μm. Calculate the relative refractive index difference for the fiber.

3. Explain the Following:

   a) Attenuation Losses
   b) Absorption Losses
   c) Linear and non-linear scattering losses

4. What do you mean by Dispersion? What are its consequences? Also explain the overall fiber dispersion.

5. The average Data power launched into a 10 km length of the fiber is 100 μW and the average output power is 2.5 μw. Calculate:

   i.   Signal attenuation per Km of this fiber
   ii. Overall signal attenuation for 11 KM Data link using the same fiber with 03 splices each having attenuation of 0.8 dB.

6. Write notes on Broadening of pulses in fiber dispersion.

7. How the fiber bending losses occur in multimode step index and graded index fibers, Explain? Also elaborate the Dispersion shifted and dispersion flattered fibers Practical fiber profiles.

8. Explain the following terms:

   i.   Single mode fiber
   ii. Plastic clad
   iii. All plastic fibers

ASSIGNMENT–3

1. Draw the Schematic diagram of high radiance Surface Emitter LED and explain the working in detail, discussing their relative merits and drawbacks.

2. Discuss the advantages and drawbacks of LED in comparison with Injection Laser for use as a source in Data communication.

3. The external power efficiency of a planar GaAs LED is 1.5%. When the forward is 50 mA and the potential difference across its terminal is 2V. Estimate the Data power generated within the device if the transmission factor at the coated GaAs-air interface is 0.8.

4. A gallium arsenide injection laser with a cavity of length 500 μm has a loss coefficient of 20 cm^{-1}. The measured differential external quantum efficiency of the device is 45%. Calculate the internal quantum efficiency of the Laser. The refractive index of gallium arsenide is 3.6.

5. Briefly describe what is meant by the following terms when they are in relation to the Injection Lasers: (i) Relaxation Oscillator (ii) Self Pulsations (iii) Mode Hopping (iv) Partition Noise

6. LED to fiber launch systems

7. Explain the following terms:

   a. Burrus type double hetro-structure
   b. Shape geometry
   c. Edge emitting LEDs
8. What are Fabry-Perot lasers quantum well lasers and distributed feedback lasers?
9. What do you mean by Dispersion? What are its consequences? Also explain the overall fiber dispersion.
10. What are methods to extend the range of the power measurement?

ASSIGNMENT – 4

1. A photo diode has a quantum efficiency of 65% when photons of energy 1.5×10^{-19} J are incident upon it: (i) At what wavelength is the photodiode operating (ii) Calculate the incident Data power required to obtain a photocurrent of 2.5 µA when the photodiode is operating as described above.

2. What are the different modes of operation of the Gunn Diode?

3. **a)** Explain the operation of the varactor diode with help of labeled diagram.

   b) Discuss the constructional details, equivalent circuits and figure of merit. Also mention its applications.

4. What is Parametric Amplifier? How it is different from a normal amplifier?

5. Explain the operation of the varactor diode. Discuss the construction details, equivalent circuit and figure of merit.

6. Discuss the principles of MASERS. Also mention its performance characteristics.

7. What are methods to extend the range of the power measurement?

8. Describe the method used for the measurement of the phase shift in a microwave network using microwave bridges.

9. Explain with a neat diagram the operation of the variable phase changer.

10. Why are attenuators needed? Compare fixed versus variable attenuator.