WEST VIRGINIA UNIVERSITY

College of Engineering and Mineral Resources
Lane Department of Computer Science and Electrical Engineering
EE 437 Fiber Optic Communications

Fall 2014- 3 Credit Hours

Instructor: Dr. Mark A. Jerabek Phone: 293-9695
Room 929 ESB email: **jerabek@csee.wvu.edu**

Office Hours:10:00-11:00 am MWF, 3:30-4:00 TTh, or by appt.
Class time: 9:00-9:50 am, MWF Class Location: ESB 355
Prerequisites: EE 345 and EE 329

Required Text: Fiber OpticCommunications, Joseph Palais, 5th Ed., Prentice-Hall 2005

Description: This course is an introduction to fiber optic communication systems. It is intended for upper level undergraduates or first year graduate students who have basic coursework background in fundamentals of communication systems, electronic devices, and electromagnetics. Homework problems often use spec. sheets from component manufacturers, and some demonstrations are used to illustrate concepts discussed in class.

Objectives: A basic understanding of the essential concepts in fiber optic communication systems, and an ability to implement them if desired. Appreciation of the strengths and weaknesses of communication systems utilizing fiber optics.

Outcomes (EE 1,2,6&7):

- Understand the role played by fiber optic communication and how it fits into the overall electronic communication system worldwide.
- Be able to explain simple ray optics and simple diffraction theory as applied to simple lenses
- Be able to explain light pulse dispersion, modal distortion and their effect on information transmission rates in fiber systems
- Understand propagation ,reflection,and refraction of plane waves in dielectrics and how this accounts for propagation of light in fibers and optical waveguides
- Be able to explain the basic operation of LEDs and Laser Diodes, and how they are used as light sources in fiber optic systems
- Be able to explain basic operating principles and use of pin diodes and avalanche photodiode detectors in fiber optics
- Know how the speed constraints of components in a fiber optic system interact to determine overall system performance
- Understand the operational principles of passivecomponents used in fiber networks and those of in-line fiber amplifiers

Be able to do basic fiber optic system design using manufacturers data sheets

OPERATION of EE 437

General: Attendance will not be taken , but is recommended since problems are often discussed in class. The in class midterm will be announced one week in advance of the exam date. The final exam may have an in class component as well as a take-home component. Homework sets (~5 or 6) will be assigned throughout the semester and will be due on the date printed on the assignment. Late homework will be docked 10% unless previous arrangements are made with the instructor. Students are STRONGLY encouraged to do their OWN work.

Grading: The relative weights of the various components in your grade are as follows:

Homework	55%
Midterm	25%
Final	20%
	100%

At the end of the semester all student grades will be computed using the weights shown above, the grades will be placed in rank order, and the cut points will be made according to where the gaps fall. In other words you will be graded on the curve, with the understanding that the class is too small to yield a statistically correct Gaussian curve to determine the cut points.

WVU is committed to social justice. The instructor of this class concurs with WVU's commitment and expects to maintain a positive learning environment based on open communication, mutual respect, and nondiscrimination. In plain English, this means that your grade in this course will be determined strictly by your honesty, your level of effort, your innate abilities, and how these translate into performance on homework and tests as compared to the performance of your classmates, and nothing else. Any suggestions as to how to further a positive and open environment will be appreciated and given serious consideration. If you are a person who has some type of disability that you feel will interfere with your ability to perform in this class, please advise the instructor EARLY in the semester and make appropriate arrangements with Disability Services (293-6700).

Lecture Schedule

Topic	Approx. # of 50 Min. Periods
1) Introduction and Overview	7.5
2) Units and basic power calculation	
3) Ray optics/Simple Lenses	
4) Imaging, Numerical Aperture, Diffraction	
5) Electromagnetic Wave Theory of Light	
6) Dispersion, Pulse Distortion, and Information Rate	
7) Polarization and Reflection at plane Boundaries	
8) Critical angle, phase shifts, evanescent waves	
9) Light Propagation in Waveguides	8
10) Modes in Symmetric Slab Waveguides	
11) Optical Fiber Modes and Configurations	
12) Specialty Fibers and Fiber Fabrication	
13) Mechanical Properties of Fibers and Cables	
14) Signal degadation in Optical Fibers	7.5
15) Attenuation,Absorption , and Scattering	
16) Dispersion: Material/waveguide/Polarization- SI Fibers	
17) Intermodal Distortion-SI fibers	
18) Dispersion and Distortion in GRIN and Single Mode Fibers	
19) Optical Sources	9
20) Semiconductor review- LED Operation	

21) Efficiency and Modulation of LEDS

22) Laser Diode Theory/Construction

23) Laser Diode Operating Characteristics/Limitations

24) Summary and Comparison of LEDs and Laser Diodes

25) Power Launching and Coupling in Fibers 4.5

26) Numerical Aperture/Light Source Coupling

27) Fiber Joints, Splices,and Connectors

28) Photo Detectors 7.5

29) Pin Diodes and Avalanche PhotoDiodes

30) Photodetector Noise and Speed of Response

31) Network Devices 4.5

32) Directional Couplers and Splitters

33) Fiber Amplifiers

34) Wavelength Division Multiplexers