EET 145

FIBER OPTICS

COURSE DESCRIPTION

A study of fiber optics as it pertains to the communications process. Topics include the physics and behavior of light in a fiber. Skills learned include connectorization of fiber and the use of the special tools and test equipment required. Successful completion of this course can lead to FOA certification.

Text(s): FOA Reference Guide to Fiber Optics
ISBN 1-4392-5387-0

Prerequisites: MAT038 and EET138 or EET130

Credits: 3
Lecture Hours: 2
Studio/Lab Hours: 3

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Office: ET130
609-570-3751

Latest Review: Spring 2019

GENERAL OBJECTIVES

Student will be able to demonstrate:

1. Determine the losses of a jumper cable.
2. Take data, normalize the data, and plot dB vs angle for numerical aperture.
3. Plot dB vs microns for axial misalignment, and also for air gap.
4. Install, cleave, polish and test: ST and SM style connectors on multimode fiber.
5. Describe the four key characteristics of an OTDR display.
6. Measure the light power exiting a cable or port.
7. Complete a link loss budget analysis on a system.
8. Use Snell’s Law to determine the index of refraction or angle of refraction.
9. Calculate critical angle, numerical aperture and acceptance angle for a given fiber.
10. Calculate Mode Volume Number and the number of modes for a given fiber.

General Education Knowledge Goals [ GEKG ]

Goal 1. Communication. Students will communicate effectively in both speech and writing.
Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.
Goal 3. Science. Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.
Goal 4. Technology. Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.
MCCC Core Skills [ CS ]

Goal A. Written and Oral Communication in English. Students will communicate effectively in speech and writing, and demonstrate proficiency in reading.

Goal B. Critical Thinking and Problem-solving. Students will use critical thinking and problem solving skills in analyzing information.

Goal D. Information Literacy. Students will recognize when information is needed and have the knowledge and skills to locate, evaluate, and effectively use information for college level work.

Goal E. Computer Literacy. Students will use computers to access, analyze or present information, solve problems, and communicate with others.

Goal F. Collaboration and Cooperation. Students will develop the interpersonal skills required for effective performance in group situations.

UNIT OBJECTIVES

Unit 1

Students will be able to:

1. List the two major advantages of fiber over copper.
2. List the three main components of a communication system.
3. Set up an experiment and determine the index of refraction (N) of a Lucite block.
4. Calculate the speed of light through a material of given N
5. Given the upper and lower cutoff frequencies, calculate the bandwidth (BW)
6. With regard to constructive and destructive interference, explain why not all light rays are reflected from a surface.
7. Calculate numerical aperture, mode volume number, and number of modes.
8. Identify single mode, Multimode step index and multimode graded index fiber from a cross sectional drawing and refractive index profile.

Unit 2

Student will be able to:

1. Calculate Av numerical power gain.
2. Calculate gain G in dB.
3. Convert Av to dB and dB to Av
4. Convert power in mw to dBm and dBm to mw.
5. Given any 2 of power out, power in and gain (loss); calculate the unknown.
6. Use a microscope to observe quality of a fiber end.
7. Be able to set up a light source and power meter to determine the loss of a fiber system.
8. Identify the principle connectors used in the fiber industry.
10. Describe what causes loss in a fiber.
11. Calculate the dispersion given the critical angle, core index, and length of cable.
12. Identify the 3 primary transmission wavelength windows.
13. Identify the following cables: telephone twisted pair, Cat 5, coax, and fiber.
14. Describe the difference between metallic, non-metallic and composite cables.
Unit 3

Student will be able to:

1. Describe the difference between PIN diodes and APDs as detectors.
2. Describe the difference between LEDs and Lasers as sources.
3. Calculate system BW given the source, detector and link information.
4. Prepare a multimode fiber for adding an ST or SM connector.
5. Install, cleave and polish ST and SM connectors.
6. Determine the losses of a fiber cable or link using appropriate equipment.
7. Perform a link loss budget analysis for a given system.
8. Review the loss analysis and determine if an amplifier or attenuator is needed.
9. Given a fiber specification sheet and operating conditions, determine the loss and BW.

METHOD OF INSTRUCTION

Learning will take place via classroom instruction, demonstrations, and student activities, as well as through textbook reading and homework assignments. Lab activities augment these experiences.

Use of equipment and manual skills will be developed in the lab.

GRADING

- Students’ achievement of the course objectives will be evaluated through the use of the following
- Active participation in class
- Three Unit tests assessing students’ comprehension of terminology, calculations and practices related to the unit objectives.
- Three lab reports

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Attendance Policy:

Mercer County Community College does not have a “cut system.” Students are expected to attend all classes of every course on their schedules. Only illness or serious personal matters may be considered adequate reasons for absence.

It is the prerogative of the instructor to excuse absences for valid reasons, provided the student will be able to fulfill all course requirements.

IF YOU MISS A CLASS IT IS YOUR RESPONSIBILITY TO GET NOTES FROM SOMEONE IN THE CLASS

Student performance in classes is formally verified at the middle of each full semester. If a student’s attendance has been infrequent or performance unsatisfactory, he or she may receive notification in the mail. At any time, the instructor may withdraw the student from class for insufficient attendance.

Academic Integrity:

Students are expected to comply with the college-wide requirements for academic integrity. Mercer County Community College is committed to Academic Integrity—the honest, fair, and continuing pursuit of knowledge, free from fraud or deception. This implies that students are expected to be responsible for their own work. Presenting another individual’s work as one’s own and receiving excessive help from another individual will qualify as a violation of Academic Integrity. The entire policy on Academic Integrity is located in the Student handbook and is found on the college website (http://www.mccc.edu/admissions_policies_integrity.shtml).

Withdrawal Course Requirements: Deadline: See Campus Calendar

To receive a W grade for any course, a student must consult with the course instructor or an appropriate division representative and then withdraw officially before two-thirds of the course has been completed by submitting a withdrawal form to the Office of Student Records. Withdrawal after this point results in a grade other than W (usually F). At any time before two-thirds of the course has been completed, the instructor may also withdraw with a W grade any student who has been absent excessively. A student thus withdrawn will not be entitled to any refund of tuition or fees. The student may appeal this action.