STATE UNIVERSITY OF NEW YORK
COLLEGE OF TECHNOLOGY
CANTON, NEW YORK

MASTER SYLLABUS

ELEC 375 – Fiber Optic Communications

Prepared By: Stephen Frempong

SCHOOL OF ENGINEERING TECHNOLOGY
ELECTRICAL ENGINEERING TECHNOLOGY & ENGINEERING SCIENCE
DEPARTMENT
FALL 2018

A. TITLE : Fiber Optic Communications

B. COURSE NUMBER: ELEC 375

C. CREDIT HOURS: (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity)
Credit Hours: 3
Lecture Hours: 2 per week
Lab Hours: 2 per week
Other: per week

Course Length: 15 Weeks

D. WRITING INTENSIVE COURSE: NO

E. GER CATEGORY

F. SEMESTER OFFERED: SPRING/FALL

G. CATALOG DESCRIPTION:
This course focuses on the transmission of information using fiber optics technologies. Topics include: Optical Fiber, Amplifiers, Transmitters, Receivers, Transceivers, Detectors, Modulation, Multiplexing, Optical Networks, Optical Sources and De-modulation

H. PRE-REQUISITES: ELEC 231 [Electronic Circuits], or permission of instructor.

CO-REQUISITE: NONE

I. GOALS (STUDENT LEARNING OUTCOMES)

Institutional Student Learning Outcome (ISLO's)

(1) Communication Skills (2) Critical Thinking (3) Foundational Skills (4) Social Responsibility (5) Industry, Professional, Discipline-Specific Knowledge and Skills.

Accreditation Board for Engineering and Technology ABET- Student Outcomes (a-k)

Course Objectives	ABET- Students Outcomes (a-k)	ISLO's

a. Establish the need for semiconductor optical source, and determine the differences between LEDs and Laser diodes in terms of operating characteristics and performance. b. Describe in detail the types, structure, and operating characteristics of laser diodes.	(a) An ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities.	(2) Critical Thinking (5) Industry, Professional, Discipline-Specific Knowledge and Skills.
c. Discuss, in detail, resonant cavity enhanced (RE) photo-detector diodes in terms of wavelength selectivity, and quantum efficiency. d. Describe the operation of optical amplifiers in applications such as STM and SONET. Establish design guidelines for optical transceivers, and determine the role of laser based optical transceivers in fiber optics communications systems.	(b) An ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies.	(2) Critical Thinking (5) Industry, Professional, Discipline-Specific Knowledge and Skills.
e. Describe the various methods of fiber alignment, and establish the need for fiber upgrading and describe the role of dispersion compensation fibers. f. Perform experiments in optical modulation, and establish the need for advanced multiplexing techniques required for high-speed optical communications systems. Distinguish between point-to-point and multipoint networks.	(c) An ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes.	(2) Critical Thinking (5) Industry, Professional, Discipline-Specific Knowledge and Skills.

J. APPLIED LEARNING COMPONENT: CLASSROOM/LAB

K. TEXTS:

Harold Kolimbiris, Fiber Optics Communications,
1st Edition, Upper Saddle River, New Jersey: Prentice-Hall, 2004.
OR, as determine by instructor.

L. REFERENCES:

Joseph C. Palais, Fiber Optic Communications, 5th Edition. Upper Saddle River, New Jersey: Prentice-Hall, 2005.

M. EQUIPMENT: Fiber optics laboratory equipment will be purchased.

Example: Laser Insertion Panel, Cable Set, Lens Set, Digital Photometer, X-Y Pattern Generator, Fiber Optic Communications & Networking Module, Cable Slicing Tools, Connectors, Fiber Optic Crimp Tools, Inspection Microscope, and Fiber Optic Test Set.

N. GRADING METHOD: A-F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS: Tests, Class participation, Assignment, and Laboratory project.

P. DETAILED COURSE OUTLINE

1. ELEMENTS OF OPTICS AND QUANTUM PHYSICS
    a. Elements of Geometric Optics
    b. Elements of Physical Optics
    c. Absorption
    d. Scattering
    e. Dispersion
    f. Wave Polarization
    g. Elements of Quantum Optics
2. OPTICAL AMPLIFIERS
    Types of Optical Amplifiers
    a. Raman Optical Amplifiers
    b. Semiconductor Optical Amplifiers
    c. Erbium Doped Fiber Amplifiers
    d. Applications: 155 Mb/s SONET/OC3-STM
3. OPTICAL DETECTORS
    a. Photodetection
    b. PIN Photodetectors
    c. Avalanche Photodetectors
    d. Advanced Optical Semiconductors Devices
4. OPTICAL TRANSMITTERS
    a. The Multiplexer
    b. Laser Drivers
    c. Externally Modulated Laser Diodes

d. The Effect of Noise and Power Supply Noise Rejection
e. 10 Gb/s DWDM Optical Transmitters

5. OPTICAL RECEIVERS
   a. Data Patterns
   b. Photodetector Diodes
   c. Classification of Optical Receivers
   d. Transimpedance Amplifiers
   e. Data and Clock Recovery Circuits
   f. Optical Receiver Performance
6. OPTICAL MODULATION
   a. Light-Emitting Diode Modulation and Circuits
   b. Laser-Diode Modulation and Circuits
   c. Analog-Modulation
   d. Digital-Modulation
   e. Electroabsorption Modulator
   f. The Mach Zehnder (LiNbO3) Optical Modulator
7. MULTIPLEXING
   a. Frequency Division Multiplexing
   b. Time Division Multiplexing
   c. Wavelength-Division Multiplexing
   d. DWDM Multiplexing
   e. AWG Multiplexers/Demultiplexers
8. OPTICAL NETWORKS
   a. Network Transport Architecture
   b. LAN Standards
   c. Fiber Channel
   d. Asynchronous Transfer Mode
   e. ATM or Broadband ISDN Protocol
   f. Synchronous Optical Networks (SONET)

Q. <u>LIBORATORY OUTLINE</u>

1. Fusion Splicing Techniques
2. Fiber Connector Technology
3. Optical Power Splitters
4. Wavelength Division Multiplexing
5. Tyndall's Light-Guiding-in-Water
6. Scattering of Light
7. Fiber Optic Switching Networks
8. Fiber Termination Polishing and Splicing
9. Infrared Light Conversion
10. Laser Focusing, Convergence, and Divergence of the Beam
11. Collimating the Beam
12. Wideband Video Communications
13. Voice Transmission Over Fiber
14. Infrared Remote Control Transmitter

15. Infrared Proximity Detector
16. Fiber Sensors
17. Attenuation in Optical Fiber