EE412 Lightwave Communication (3-0)

2020 Spring, Tuesday: 9:45-12:30

Text Books:

Fiber Optic Communications, Fundamentals and Applications

Shiva Kumar, M. Jamal Deen
Wiley

*** Fiber Optics and Optoelectronics ***

R.P Khare
Oxford Higher education

Additional Reading:

Optoelectronics and Photonics
S.O Kasap
Pearson

Fundamentals of Photonics
B.E.A. Saleh, M.C. Teich
Wiley-Inter science

Optical Fiber Communications
Principles and Practice
J. M. Senior
Prentice Hall

Papers:

Fiber-optic transmission and networking: the previous 20 and the next 20 years
Vol. 26, No. 18 | 3 Sep 2018 | OPTICS EXPRESS 24190
https://doi.org/10.1364/OE.26.024190

Vulnerabilities and security issues in optical networks
DOI: 10.1109/ICTON.2014.6876451

Digital Signal Processing for Optical Communications and Networks
http://dx.doi.org/10.5772/intechopen.68323

Course Coordinator: Dr. Kıvılcım Yüksel Aldoğan (office hours: **Monday, 10:30-12:00**)
Assistants: Ertunga B. Koçal, Şamil Şirin

Grading

Final Exam…….. 50 %
Quiz Score……. 50 %

Quiz-1: Single mode fibers and passive optical devices.
Quiz-2: Optoelectronic sources
Quiz-3: Detectors and Receiver noise analysis
Quiz-4: Optoelectronic modulators and amplifiers
Quiz-5: System design for point-to-point links

Students are expected to attend at least 70% of the lectures and problem sessions

Contents

1) Introduction
    a. Electromagnetics and optics
    b. Historical development
    c. A fiber-optic communication system
    d. Advantages of fiber-optic communication systems

2) Optical Fiber Transmission
    a. Review of Ray model of light (reflection, refraction, matrix method)
    b. Fiber structure
    c. Ray propagation in fibers
    d. Pulse propagation in single-mode fibers
    e. Single-mode fiber design considerations

3) Optoelectronic Sources
    a. Fundamental aspects of semiconductor physics
    b. The p-n junction
    c. LED designs
    d. Modulation response of an LED
    e. Conditions for Laser Oscillations
    f. Semiconductor laser diode
        i. Heterojunction lasers
        ii. Laser rate equations
        iii. Steady-state solutions of rate equations
        iv. Distributed-feedback lasers

4) Optical Receivers
    a. The basic principle of optoelectronic detection
    b. Common types of photodetectors
    c. Photodetector performance characteristics
    d. Noise considerations
    e. Direct detection receivers
    f. Coherent receivers

5) Optoelectronic Modulators and Modulation Schemes
    a. Review of basic principles
    b. Direct and external modulation
    c. Electro-optic modulators
    d. Acousto-optic modulators
    e. Digital modulation schemes (ASK, PSK, FSK, DPSK)

6) Optical amplifiers
    a. Optical amplifier model
    b. Semiconductor amplifiers
    c. Erbium-doped fiber amplifiers
    d. Fiber Raman amplifiers

7) Fiber optic communication/Transmission System Design
    a. Fiber Loss-induced limitations
    b. Dispertion-induced limitations
    c. WDMs and couplers
    d. Fiber network planning
    e. Roadmaps of optical communications

Course plan:

Week-1	Introduction
Week-2	Optical Fiber Transmission
Week-3	Optical Fiber Transmission
Week-4/1	QUIZ-1
Week-4/2	Optoelectronic sources
Week-5	Optoelectronic sources
Week-6	Optoelectronic sources
Week-7/1	QUIZ-2
Week-7/2	Optical Receivers
Week-8	Optical Receivers
Week-9/1	QUIZ-3
Week-9/2	Optical modulators and optical amplifiers
Week-10	Optical modulators and optical amplifiers
Week-11/1	QUIZ-4
Week-11/2	Transmission System Design
Week-12	Transmission System Design
Week-13	Transmission System Design
Week-14/1	QUIZ-5
Week-14/2	Performance Analysis
Week-15	Roadmaps of optical communications
Week-16	FINAL

Note
The instructor reserves the right to make changes to this syllabus as necessary.