Faculty of Engineering & Technology

Optical Fiber Communication System

Information :

Course Code :	COM 527	**Level :**	Undergraduate	**Course Hours :**	3.00- Hours

Department : Specialization of Electronics & Communication

Instructor Information :

Title	Name	Office hours
Associate Professor	KAMEL MOHAMED MAHMOUD HASSAN	6
Lecturer	MOHAMED MOUSA SAYED EMAM AHMED	8
Lecturer	MOHAMED MOUSA SAYED EMAM AHMED	8
Teaching Assistant	Ahmed Mahmoud Mohamed Mahmoud Hegazy	

Area Of Study :

Recognize the principles of operation for optical fiber waveguides as well as the transmission characteristic of optical fiber.
Develop the students' knowledge about optical fiber communication systems.
Prepare students to analyze the components of optical fiber communication system.
Perform the basic calculation of optical power budget as well as the rise time budget.
Practice students to perform basic experiments on optical fiber systems.

Description :

Overview of optical fiber communications: Historical review, the general system, and the main features. Optical Fiber waveguides: Ray theory transmission, Electromagnetic mode theory for optical propagation. Cylindrical fiber: modes, mode coupling, Step index fiber, Graded index fiber. Single mode fiber: cutoff wavelength, Mode field diameter (MFD), Effective, refractive index, and Gaussian approximation. Transmission Characteristics of optical fibers: Attenuation (material absorption, linear scattering losses, nonlinear scattering losses, and fiber bend loss, Transmission). Dispersion inter-modal dispersion, chromatic dispersion, overall dispersion. Modified single mode dispersion: DSFs, DFFs, and NZ DFs.
Optical fibers: Multi-mode Step-index fiber, Multi-mode Graded-index fiber, Single mode fiber, Plastic-clad fiber, Plastic optical fibers. Direct detection receiver performance: Noise, Receiver noise, Receiver structure. Optical fiber systems (Direct detection): introduction, Transmitter circuits, Receiver circuits, Digital system design considerations, check the system design parameters of an optical fiber link using power budget and rise time budget. Wavelength division multiplexing techniques. Optical amplifiers (SOAs and fiber amplifiers). Optical fiber Measurements: Fiber attenuation measurements, fiber dispersion measurements, Fiber cutoff wavelength, and Fiber NA measurements.

Course outcomes :

a.Knowledge and Understanding: :

1 -	. Recognize the essentials of wave propagation through optical fibers
2 -	Describe the transmission characteristics of signals over optical fibers and to be aware of the practical and fundamental limits

3 -	Review the main features of the different types of OFs, connection problems and the appropriate applications.
4 -	Summarize the operating principles of optical transmitter and receiver systems.
5 -	Interpret the latest development in optical fiber systems.
b.Intellectual Skills: :	
1 -	. Analyze the main parameters related of the main blocks of the optical fiber communication link
2 -	Compare the different types of sources, fibers, and optical detectors
3 -	Estimate the power budget and rise time budget of an optical fiber link.
4 -	Design a digital optical fiber link based on direct detection
c.Professional and Practical Skills: :	
1 -	Interpret the performance parameters for optical fiber communication subsystems.
2 -	Justify the appropriate software for optical fiber link designed.
3 -	Perform the basic measurements related to characterization of optical fibers, optical transmitter, and optical receiversôparameters.
4 -	Display the data sheets and choose the adequate components for building up a fiber communication link.
d.General and Transferable Skills: :	
1 -	Demonstrate a self-directed manner.
2 -	Show the ability to work coherently and successfully as a part of a team.
3 -	Manage time and meet deadlines.

Course Topic And Contents :

Topic	No. of hours	Lecture	Tutorial / Practical
Overview of optical fiber communications: Historical review, the general system, and the main features	5	3	2
Optical Fiber waveguides: Ray theory transmission, Electromagnetic mode theory for optical propagation	5	3	2
Optical Fiber waveguides (Continued) Cylindrical fiber: modes, mode coupling, Step index fiber, Graded index fiber	5	3	2
Optical Fiber waveguides (Continued) Single mode fiber: cutoff wavelength Mode field diameter (MFD), Effective refractive index, and Gaussian approximation	5	3	2
Transmission Characteristics of optical fibers: Attenuation{material absorption, linear scattering losses, nonlinear scattering losses, and fiber bend loss	5	3	2
Transmission Characteristics of optical fibers(continued): Dispersion inter-modal dispersion, chromatic dispersion, overall dispersion	5	3	2
Dispersion(continued) modified single mode dispersion: DSFs, DFFs, and NZ DFs	5	3	2
Optical fibers: Multi-mode Step-index fiber, Multi-mode Graded-index fiber, Single mode fiber, Plastic-clad fiber, Plastic optical fibers.	5	3	2
Direct detection receiver performance: receiver noise, receiver structure	5	3	2

Course Topic And Contents :

Topic	No. of hours	Lecture	Tutorial / Practical
Optical fiber systems {Direct detection}: introduction, Transmitter circuits, Receiver circuits, Digital system design considerations, optical power budget, and rise time budget. Check the system design parameters of an optical fiber link using Optisystem software. Wavelength division multiplexing techniques	10	6	4
Optical amplification (SOAs and fiber amplifier)	5	3	2
Optical fiber Measurements: Fiber attenuation measurements, fiber dispersion measurements, Fiber cutoff wavelength, and Fiber NA measurements.	10	6	4
Revision	5	3	2

Teaching And Learning Methodologies :

- Interactive Lecture
- Discussion
- Problem Solving
- Experimental Learning
- Cooperative Learning
- Research
- Project and Assignment

Course Assessment :

Methods of assessment	Relative weight %	Week No	Assess What
ÅFinal exam	40.00		
o Assignments and Lab Experiments	10.00		
o In Class Quizzes and Participation	20.00		
o Mid-Term Exams	30.00		

Recommended books :

1. Josef C. Palais, "Fiber Optic Communication", Prentice Hall.
2. Alan Rogers, "Essentials of Photonics" Second Edition, CRC Press, 2009.