

Syrian Arab Republic	 الجامعة الافتراضية السورية SYRIAN VIRTUAL UNIVERSITY	الجمهورية العربية السورية
Ministry of Higher Education		وزارة التعليم العالي
Syrian Virtual University		الجامعة الافتراضية السورية

## Course Definition : Optical Communications

### 1- Basic Information:

Course Name	Optical Communications
Course ID	CRF406
Contact Hours (Registered Sessions)	١٦
Contact Hours (Synchronized Sessions)	٢٤
Mid Term Exam	None
Exam	1.5
Registered Sessions Work Load	١٦
Synchronized Session Work Load	٢٤
Credit Hours	5

### 2- Pre-Requisites:

Course	ID
Digital Communications	CEE308
Geometrical optic	
Electromagnetic Theory	CRF301
English course	Level 3

### 3- Course General Objectives:

The objective of this course is to introduce the student to the fundamental principles of optical fiber communication, and to discuss the importance of this type of communication system. Optical fibers that support single and multimode transmission. Various dispersion mechanisms and signal attenuation causes are covered. The student will learn how fiber is made and also learns about the functions of passive and active optical devices, especially coherent (LASER) and incoherent (LED) optical sources and PIN and APD (avalanche photodiode) optical receivers and various noise mechanisms. The course will cover fiber communication system design and a variety of optical networking aspects and operational principles. This course introduces also the student to the technics used to link fibers to devices and to others fibers.

Future technology used to improve the quality of optical fiber communication system are quickly described.

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#### 4- Intended Learning Outcomes (ILO):

Code	Intended Learning Outcomes
ILO1	Introducing fiber optic communication systems: advantages and disadvantages
ILO2	Identifying the basic elements of optical fiber, total incidence reflection, numerical aperture fiber types and structures.
ILO3	Understanding the different kind of losses, signal distortion in optical wave guides and other signal degradation factors.
ILO4	Introducing fiber manufacturing
ILO5	Recognizing the various optical source materials, LED and Laser diodes structures.
ILO6	Identifying the basic fiber optical receivers such as PIN and APD diodes, and understanding noise performance in photodetector, and receiver operation and configuration.
ILO7	Knowing fiber optic connectors and couplers principles and some related losses
ILO8	Understanding different issues related to optical fiber communication system design and performance in a practical lightwave system.
ILO9	Understanding linking fibers technologies and introducing fibers test instruments
ILO10	Quickly describing potential further technology under developing, related to increase fibers system performance such as speed , bandwidth .and propagation distance.

#### 5- Course Syllabus (٢٤ hours of total synchronized sessions)

- **RS:** Recorded Sessions; **SS:** Synchronized Sessions;

ILO	Course Syllabus	RS	SS	Type	Additional Notes
ILO1	<b>Fiber optic history:</b> <ul style="list-style-type: none"> <li>• Elements of an optical fiber communication system.</li> <li>• Fiber optic, advantages and disadvantages.</li> </ul>		2	<input type="checkbox"/> Exercises <input type="checkbox"/> Assignments <input checked="" type="checkbox"/> Seminars <input type="checkbox"/> Projects <input type="checkbox"/> Practices <input type="checkbox"/> Others	typical coverage is found in Ref1 and Ref 2 .
ILO2 ILO3	<b>Optical Fiber:</b> <ul style="list-style-type: none"> <li>• Geometric optics: reflection, refraction, total incidence reflection, critical angle</li> <li>• Types of fiber: step index and Graded index fibers,</li> <li>• Dispersion</li> <li>• Attenuation</li> </ul>	3	6	<input checked="" type="checkbox"/> Exercises <input type="checkbox"/> Assignments <input checked="" type="checkbox"/> Seminars <input type="checkbox"/> Projects <input type="checkbox"/> Practices <input type="checkbox"/> Others	typical coverage is found in Ref1-Ref 4- Ref5 .
ILO4	<b>Fibers and cables:</b> <ul style="list-style-type: none"> <li>• Fiber fabrication</li> <li>• Types of fiber:</li> </ul>	2	3	<input checked="" type="checkbox"/> Exercises <input type="checkbox"/> Assignments <input checked="" type="checkbox"/> Seminars	typical coverage is found in Ref 3.

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	standard fiber, low water nondispersion fiber , loss minimized fiber, plastic fibers, polarization maintaining fiber, • Fiber cables			<input type="checkbox"/> Projects <input type="checkbox"/> Practices <input type="checkbox"/> Others	
ILO5	<b>Optical Transmitters:</b> • Structure and materials of LED and LD sources • LED Operating characteristics • Semiconductor lasers • Optical Transmitter Design	2	2	<input checked="" type="checkbox"/> Exercises <input type="checkbox"/> Assignments <input checked="" type="checkbox"/> Seminars <input type="checkbox"/> Projects <input type="checkbox"/> Practices <input type="checkbox"/> Others	typical coverage is found in Ref 3 –Ref4
ILO6	<b>Optical Receivers:</b> • Physical Principles of Photodiodes • Pn photodiodes • Pin photodiodes • Avalanche photodiodes.	2	2	<input checked="" type="checkbox"/> Exercises <input type="checkbox"/> Assignments <input checked="" type="checkbox"/> Seminars <input type="checkbox"/> Projects <input type="checkbox"/> Practices <input type="checkbox"/> Others	typical coverage is found in Ref3 – Ref4
ILO7	<b>Fiber optics connectors and couplers:</b> • Connectors principals, • Optical couplers	2	2	<input checked="" type="checkbox"/> Exercises <input type="checkbox"/> Assignments <input checked="" type="checkbox"/> Seminars <input type="checkbox"/> Projects <input type="checkbox"/> Practices <input type="checkbox"/> Others	typical coverage is found in Ref 8-Ref13
ILO8	<b>Fiber optic communication systems:</b> • Communication networks, • Analog and digital signals • Multiplexing techniques • System calculation • Example of system design	3	3	<input checked="" type="checkbox"/> Exercises <input type="checkbox"/> Assignments <input checked="" type="checkbox"/> Seminars <input type="checkbox"/> Projects <input type="checkbox"/> Practices <input type="checkbox"/> Others	typical coverage is found in Ref4 - Ref 7 – Ref10
ILO9	<b>Assembling and testing:</b> • Linking optical fibers and devices. • Connectors technology • Splices • Light losses in optical fiber joint • Test instruments OTDR, PM, VIS	2	2	<input checked="" type="checkbox"/> Exercises <input type="checkbox"/> Assignments <input checked="" type="checkbox"/> Seminars <input type="checkbox"/> Projects <input type="checkbox"/> Practices <input type="checkbox"/> Others	typical coverage is found in Ref6 - Ref 8 – Ref9
ILO10	<b>Future steps:</b> • Laser and amplifier • Fiberless optical transmission • Optical computer		2	<input type="checkbox"/> Exercises <input type="checkbox"/> Assignments <input checked="" type="checkbox"/> Seminars <input type="checkbox"/> Projects <input type="checkbox"/> Practices	typical coverage is found in Ref 1

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				Others	
				<input type="checkbox"/>	

## 6- Assessment Criteria (Related to ILOs)

ISC	Interactive Synchronized Collaboration	Ex	Exams	Rpt	Reports
PF2F	Presentations and Face-to-Face Assessments	PW	Practice Work		

ILO Code	ILO	Intended Results	Assessment Type				
			ISC	PW	Ex	PF2F	Rpt
ILO1	Introducing fiber optic communication systems: advantages and disadvantages		X				
ILO2	Identifying the basic elements of optical fiber, total incidence reflection, numerical aperture fiber types and structures.		X	X	X		
ILO3	Understanding the different kind of losses, signal distortion in optical wave guides and other signal degradation factors.		X	X	X		
ILO4	Introducing fiber manufacturing		X	X	X		
ILO5	Recognizing the various optical source materials, LED and Laser diodes structures.		X	X	X		
ILO6	Identifying the basic fiber optical receivers such as PIN and APD diodes, and understanding noise performance in photodetector, and receiver operation and configuration.		X	X	X		
ILO7	Knowing fiber optic connectors and couplers principles and some related losses		X	X	X		
ILO8	Understanding different issues related to optical fiber communication system design and performance in a practical lightwave system.		X	X	X		
ILO9	Understanding linking fibers technologies and introducing fibers test instruments		X	X	X		
ILO10	Quickly describing potential further technology under development related to increase fibers system performance such as speed , bandwidth .and propagation distance.		X				

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## 7- Practice Tools (Option to be provided):

Tool Name	Description
<b>OptiSystem</b> Optical communication system design software	An innovative optical communication system simulation package that <i>designs, tests, and optimizes</i> virtually any type of optical link in the physical layer of a broad spectrum of optical networks. It is a system level simulator based on the <i>realistic modeling</i> of fiber-optic communication systems. It has a huge database of active and passive components, including power, wavelength, loss and other related parameters.

## 8- Main References

1- Optoelectronics and fiber optic technology, by Ray Tricker, Elsevier Science 2002
2- Fiber-Optic Communication Systems', 4 <sup>th</sup> ed., by Govind P. Agrawal, John Wiley & Sons, 2002.
3- Fiber optic communications, by Joseph c. Palais 5 <sup>th</sup> edition, Pearson, 2005
4- Fundamentals of photonic, by Chandra Roychoudhuri SPIE press, 2008
5- Principals of fiber optic communication, course 2 by CORD communication 2008
6- Reference guide to fiber optic testing, second edition ,by JDS Uniphase company 2011.
7- Basic principles of fiber optic, by Corning Incorporated 2006.
8- Fiber optic connectors and splicing module, by Industrial fiber optics 2009

## 9- Additional References

9- Optical Fiber Communications principals and practice', by Senior John M, Pearson Education, 2009.
10- Fiber-Optic Communication Systems', 4 <sup>th</sup> ed., by Govind P. Agrawal, John Wiley & Sons, 2012.
11- 'An Introduction to Fiber Optics', by Ajoy Ghatak, K. Thyagarajan, Cambridge University Press, 1998.
12- Optical Communication Essentials', by Gerd Keiser, McGraw-Hill, 2003.
13- Handbook of optical fiber cable jointing by ministry of Railways, india 2013