

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Optical Fiber		Module Delivery
Module Type	C		☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar
Module Code	ATU11610		
ECTS Credits	6		
SWL (hr/sem)	150		
Module Level	UGIII	Semester of Delivery	
Administering Department		College	NETC
Module Leader		e-mail	
Module Leader's Acad. Title		Module Leader's Qualification	
Module Tutor	Name (if available)	e-mail	
Peer Reviewer Name	Nasir Hussein Selman	e-mail	Coj.nas@atu.edu.iq
Scientific Committee Approval Date	01/05/2025	Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	During this course, students will be: 1- Study the basic principle of optical communication and optical fiber and its elements 2- Understand the available analytical methods to evaluate their performance and key design features. 3- Examine and think critically about historical technology solutions in the evolution of optical communication. 4- Understand the design of transceiver in optical communications.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Upon completion of this course students will be able to: 1- Describe and mathematically analyze optical components used in communication systems. 2- Understand the principles of optical communication system design. 3- Identify and describe the major sources of noise and signal impairments in an optical communication system.
Indicative Contents المحتويات الإرشادية	1- Principle of optical communication and optical fiber. 2- Degradation in optical fiber 3- Optical transmitters and receiver.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	87	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation					
تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	Midterm Exam	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Overview of Optical fiber: Introduction, Historical development, general system, advantages & disadvantages, applications of optical fiber communication, and optical fiber waveguides.
Week 2	Ray theory transmission: internal reflection, Acceptance angle, Numerical aperture, Skew rays.
Week 3	Electromagnetic mode theory for optical propagation: Modes in a planar guide, Phase, group velocity.
Week 4	Manufacturing: Manufacture of optical fiber, Modified chemical vapor deposition (MCVD), outside vapor deposition (OVD), Fiber materials.
Week 5	Cylindrical fiber: Modes in optical fiber, Mode coupling, Step & Graded index fibers, normalized frequency, plastic and glass OF, propagation of light in OF
Week 6	Single-mode fibers: Cutoff wavelength, Mode-field diameter and spot size, Effective refractive index, Group delay and mode delay factor.
Week 7 & 8	Degradation optical fiber: Attenuation, Material absorption losses in silica glass fibers (Intrinsic & Extrinsic absorption), Linear scattering losses (Rayleigh & Mie scattering), Bending losses, core and cladding losses, Nonlinear scattering losses (Stimulated Brillouin & Stimulated Raman scattering).
Week 9	Dispersion: Chromatic dispersion:, material dispersion, waveguide dispersion, polarization mode dispersion, polarization maintaining fiber.
Week 10	Mid-Term Exam
Week 11	Intermodal dispersion: Multimode step index fiber, Multimode graded index fiber, waveguide dispersion,
Week 12	Modulation: Nonlinearity in optical fiber, self-phase modulation, cross-phase modulation, four-wave mixing.
Week 13&14	Optical sources and transmitters: transmitter in optical system, Light Emitting Diode, LED power and efficiency, LED structures, LED characteristics, Modulation, Laser diode, principle of working of laser diode, laser diode characteristic. laser diode driver circuit.

Week 15	Optical Receiver: Fundamentals, Optical Detectors, Noise Sources in a Receiver, Quantum efficiency, Responsivity, Avalanche photodiodes, Phototransistors.
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Introduction to optical communication system components (sources, fibers, detectors)
Week 2	Study of light and lasers used in optical communications.
Week 3	Measurement of laser characteristics (wavelength, beam width, stability).
Week 4	Characteristics of Light Emitting Diode (LED) vs. Laser Diode (LD).
Week 5	Basic optical link using LED – Fiber – Photodetector.
Week 6	Experiment: Measurement of attenuation in optical fibers.
Week 7	Effect of wavelength on attenuation.
Week 8	Bending loss in optical fibers.
Week 9	Splicing and connector losses.
Week 10	Fiber testing using OTDR (Optical Time Domain Reflectometer).
Week 11	Mid-Term Exam
Week 12	Characteristics of PIN photodiode.
Week 13	Characteristics of Avalanche Photodiode (APD).
Week 14	Digital optical link transmission.
Week 15	Analog optical link transmission.
Week 16	Final Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	1- Optical Fiber Communication – Gerd Keiser, 4th Ed., MGH, 2008. 2- Optical Fiber Communications – John M. Senior, Pearson Education. 3rd Impression, 2007.	yes
Recommended Texts	Fiber optic communication – Joseph C Palais: 4th Edition, Pearson Education	no
Websites		

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks %	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.				