

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Laser Sciences		Module Delivery
Module Type	Core		☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar
Module Code	LAER111		
ECTS Credits	2		
SWL (hr/sem)	50		
Module Level	1	Semester of Delivery	
Administering Department	Lasers and Optoelectronics	College	Engineering
Module Leader	Dr. Sarmed .K.		e-mail
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	Ph.D.
Module Tutor	Dr. Lina M. Shakir		e-mail Lina.mohammed99@alayen.edu.iq
Peer Reviewer Name	Dr. Lina M. Shakir		e-mail Lina.mohammed99@alayen.edu.iq
Scientific Committee Approval Date	01/06/2023	Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	-	Semester	-
Co-requisites module	Laser Physics	Semester	4

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	1. To understand the fundamental concepts of Laser principles. 2. To provide the knowledge of Laser beam properties.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Recognize the difference between the laser beam and the ordinary light. 2. List the various terms associated with laser science. 3. Summarize what is meant by stimulated emission. 4. Discuss the energy levels of atoms and molecules. 5. Derive the Einstein relations of the two energy levels. 6. Identify the basic laser system components and their function. 7. Explain the laser light beam properties. 8. Explain the laser light beam characteristics. 9. Summarize a well-known types of laser types.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Lecture #1- <u>The Wave Nature of Light</u> [2 hr] What is light? The equation of the light wave. Lecture #2- <u>The Spectrum and Wavelength</u>[2 hr] Table of the main light wave spectrum and how to find the energy and frequency of from the wavelength and vise verse Lecture #3- <u>Energy Levels and States (Atoms and Molecules)</u> [2 hr] The main difference between Atoms and Molecules energy levels and introduction to the electronical energy levels. How to find the required energy to move a particles between a known levels. Lecture #4- <u>Blackbody Radiation</u> [2 hr] The behavior of the light beam as a function of temperature Lecture #5- <u>The Boltzmann Distribution</u> [2 hr] The ratio of a Boltzmann distribution and its normal distribution Lecture #6- <u>Absorption, Spontaneous and Stimulated Emission</u> [2 hr] The conditions of each transition of the above-mentioned emissions and the requirements for achieving each of them. Lecture #7- <u>Population Inversion</u> [2 hr] The main condition to achieve population inversion and its methodology Lecture #8- <u>Two Levels System (Einstein Coefficient)</u> [2hr] The derivative of rate equation for two level systems for all the three different transitions.

	Lecture #9- <u>Pumping Mechanisms [2hr]</u> Types of pumping Details of more popular pumping types optical and electrical How to solve the pumping rate equation Lecture #10- <u>3 and 4 Energy Level systems [2hr]</u> Laser types according to energy levels Details of 3 and 4 energy levels The main differences between 3 and 4 energy levels Lecture #11- <u>Laser Light Beam Characteristics (Spatial and Temporal) [2hr]</u> Experiment of Young and Michelson to show how the laser light beam create difference fringes according to time and space difference Lecture #12- <u>Laser Light Beam Properties (Coherency, Directionality, Monochromaticity, Brightness, Brilliance) [2hr]</u> The definition of each property for the laser light beam and how difference than ordinary light beam Lecture #13- <u>Types of Lasers according to Active Medium [2hr]</u> Brief details of the well-known laser types with a schematic drawing of the system
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1- Lectures included a very clear figures on each subject in mean. 2- Also, more clarification of schematics will be displayed on the white board. 3- Discussion and showing some attractive videos during class to clarify the behavior of the light beam so they can interactive. 4- Additionally, there are many exercises that the students could solve with others interactivity and more as home works.

Student Workload (SWL)			
الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	33	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	17	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	1.1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	50		

Module Evaluation					
تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	20% (10)	Continuous	All
	Onsite Assignments	1	5% (10)	5	All
	Online Assignments	2	10% (10)	Continuous	All
	Projects	1	5% (10)	10	All
Summative assessment	Midterm Exam	2 hr	10% (10)	6	LO # 1 to 5
	Final Exam	3hr	50% (50)	16	All
Total assessment			100%(100)		

Delivery Plan (Weekly Syllabus)	
المنهاج الاسبوعي النظري	
	Material Covered
Week 1	The Wave Nature of Light
Week 2	The Spectrum and Wavelength
Week 3	Energy Levels and States (Atoms and Molecules)
Week 4	Blackbody Radiation
Week 5	The Boltzmann Distribution
Week 6	Absorption, Spontaneous and Stimulated Emission

Week 7	Mid Exam
Week 8	Population Inversion
Week 9	Two Levels System (Einstein Coefficient)
Week 10	Pumping Mechanisms
Week 11	3 and 4 Energy Level systems
Week 12	Laser Light Beam Characteristics (Spatial and Temporal)
Week 13	Laser Light Beam Properties (Coherency, Directionality, Monochromaticity, Brightness, Brilliance)
Week 14	Types of Lasers according to Active Medium
Week 15	Preparatory week before the final Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	1- Orazio Svelto, "Principles of Lasers", FIFTH EDITION, 2010. 2- William T. Silfvast, "Laser Fundamentals", second edition, 2004.	Yes
Recommended Texts	Orazio Svelto, "Principles of Lasers", FIFTH EDITION, 2010.	Yes
Websites	1- The "Laser Adventure " by Rami ARIELI, freely available online. 2- Dr. BC Choudhary, professor, NITTTR, Sector-26, Chandigarh- 160019. Power point lectures online.	

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.				