



Ministry of Higher Education and
Scientific Research - Iraq
Al-Mansour University College
Department of Communication Engineering



الملحق 4: وصف المادة الدراسية

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Laser Principles		Module Delivery
Module Type	Core		☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar
Module Code	COM 35107		
ECTS Credits	2		
SWL (hr/sem)	50		
Module Level	UGIII	Semester of Delivery	1
Administering Department	BSc - COMM	College	Al-Mansour University College
Module Leader		e-mail	
Module Leader's Acad. Title		Module Leader's Qualification	
Module Tutor	Name (if available)	e-mail	E-mail
Peer Reviewer Name	Name	e-mail	E-mail
Scientific Committee Approval Date	13-9-2025	Version Number	1.0

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



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Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	18. Introduce the basic mathematical concepts related to laser theory. 19. Impart knowledge on the concepts of laser theory and design. 20. Impart knowledge on the concepts of laser system. 21. Impart knowledge on the concepts of types of lasers.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	This course is intended for teaching the basic principle of laser system for engineering students at the beginning graduate level. The course will have these important outcomes: 1. Understanding Energy Levels and Atomic Structure 2. Demonstrate the knowledge and understanding of the fundamental concepts, principles and theories underpinning laser system design and Electromagnetic Spectrum, in addition to principles of natural of light and the interaction between the radiations with matter. 3. Understand the Principle of Laser and use integrated approaches to solve complex problems. 4. Demonstrate achievement of a subject knowledge, particularly via seminars. 5. Solving additional, more challenging exam problems 6. Identify appropriate design and governance problems and formulate clear objectives using mathematical equations
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Course introduction (4 hrs) • Working with Power point (11 hrs) • Theoretical lectures (15 hrs)
Description	- Fundamental Concepts: - Nature of Light: Wave Theory, Electromagnetic Spectrum, Energy-mass relation, Momentum of photon. Mass of photon. – Matter: Structure of Atoms & Molecules. Energy Levels, Electronic, Vibrational and Rotational Energy Levels, Interaction of Radiation with Matter: Absorption, Spontaneous Emission, Stimulated Emission, Einstein's A & B Coefficients of Transitions, Maxwell-Boltzmann Distribution, Planck's law of blackbody radiation,



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Principle of Laser action: Population inversion, metastable states, gain medium, Pumping mechanisms, feedback mechanism, threshold condition for laser beam generation.,

Optical Resonators: Types of Resonators, Stability Criteria, g-parameters.,

Characteristics of Laser Beams: Monochromaticity, Directionality, Brightness, Coherence: temporal & spatial, Focus ability, Ultra-short pulse generation.

- **Longitudinal & Transverse Modes** : Temporal modes, Spatial Modes & characteristics,

Types of Lasers: Three- level and Four-level Lasers, Solid, Liquid and Gas Lasers. Brief description of Ruby, He-Ne, Nd:YAG, Carbon Dioxide Lasers, Semiconductor Lasers. X-Ray Lasers, Free-electron Lasers. Fiber Lasers.

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies

In this course, students are guided by:

- Using different examples.
- Using different styles of discussion that aim to connect the theoretical and practical sides.
- Asking questions and giving exercises that require analysis and conclusions related to lectures.
- Encourage students to participate in discussions and do the practical work.
- Encourage students to work in groups.

Student Workload (SWL)

الحمل الدراسي للطلاب محسوب لـ ١٥ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطلاب خلال الفصل	33	Structured SWL (h/w) الحمل الدراسي المنتظم للطلاب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطلاب خلال الفصل	17	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطلاب أسبوعيا	1.1
Total SWL (h/sem) الحمل الدراسي الكلي للطلاب خلال الفصل	50		



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Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	20% (5)	6 and 12	LO #1 to #3 , #4 to #6
	Assignments	2	10% (5)	2 and 13	LO #3 to #6
	Projects / Lab.				
	Report	1	10% (10)	13	LO #3, #4 and #6
Summative assessment	Midterm Exam	1hr	10% (10)	9	LO #1 - #5
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	- Review of Nature of Light, Wave Theory, Electromagnetic Spectrum, Energy-mass relation, Momentum of photon. Mass of photon
Week 2	Fundamental parameters of Matter, Structure of Atoms & Molecules. Energy Levels, Electronic, Vibrational and Rotational Energy Levels with Examples. Two-level representation
Week 3	Interaction of Radiation with Matter, Absorption, Spontaneous Emission, Stimulated Emission, Einstein's A & B Coefficients of Transitions
Week 4	Maxwell-Boltzmann Distribution, Planck's law of blackbody radiation.
Week 5	Principle of Laser action: Population inversion, metastable states, gain medium,
Week 6	Pumping mechanisms, feedback mechanism, threshold condition for laser beam generation.



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Week 7	Overview of Optical Resonators , Types of Resonators,
Week 8	Stability Criteria, g-parameters.
Week 9	Characteristics of Laser Beams: Monochromaticity, Directionality, Brightness, Coherence:
Week 10	Types of coherent: temporal & spatial, Focus ability, Ultra-short pulse generation.
Week 11	Longitudinal & Transverse Modes : Temporal modes, Spatial Modes & characteristics
Week 12	Design procedure of Arrays Antennas
Week 13	Types of Lasers: Three- level and Four-level Lasers, Solid, Liquid and Gas Lasers. X-Ray Lasers,
Week 14	Brief description of Ruby, He-Ne, Nd:YAG, Carbon Dioxide Lasers, Semiconductor Lasers.
Week 15	Free-electron Lasers. Fiber Lasers.

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	• Laser Principles, Types & Applications: K R Nambiar, New Age International, 2004.	No
Recommended Texts	• Lasers: Theory and Applications : A K Ghatak and K Thyagarajan, McMillan, 2003	No
Websites	None	



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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.