Course Specification

(Postgraduate Programs)

Course Title:	Lasers and Electro-Optics
Course Code:	2202-575
Program:	Master in Electrical Engineering
Department:	Electrical Engineering
College:	College of Engineering
Institution:	King Faisal University
Version:	V2
Last Revision Date:	17 April 2025

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A. General information about the course:

1. Course Identification:

1. Credit hours: (3)				
2. Course type				
A.	☐ University	☐ College	☒ Department	☐ Track
B.	☐ Required		☒ Elective	
3. Level/year at which this course is offered: Level 2/1st year				
4. Course General Description:				
This course gives a detailed description of the basic description of light in terms of electro-magnetic fields. Relevant aspects of geometric and physical optics as well as physics of radiation will be reviewed. The propagation of light through materials and the optical response of materials are used to introduce nonlinear optical phenomena, including optical amplification. The properties of resonators and the basic operation of lasers are discussed and the unique properties of laser radiation are described. These topics are described in the context of representative laser systems and their industrial applications as well as optical mirrors, detectors, modulators, optical fibers, etc.				
5. Pre-requirements for this course (if any)**:**				
None				
6. Co-requisites for this course (if any)**:**				
None				
7. Course Main Objective(s):				
The course gives advanced knowledge on physics and applications of lasers and other electro-optic devices.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid		

No	Mode of Instruction	Contact Hours	Percentage
	• Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	45
2.	Laboratory/Studio	
3.	Field	
4.	Tutorial	
5.	Others (specify)……	
	Total	45 Hours

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Ability to describe optical processes and understanding of plane waves and ability to apply mathematics; Knowledge of the interaction between light and materials.	K1	Lectures	Final Exam M.T. Exam HW, QZ
1.2	Ability to recognize different types of lasers and light resonators	K1	Lectures	Final Exam M.T. Exam HW, QZ

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.3	Ability to describe optical resonators and apply to laser principles	K1	Lectures	Final Exam M.T. Exam HW, QZ
1.4	Understanding of laser oscillation and application to operations	K1	Lectures	Final Exam M.T. Exam HW, QZ
1.5	Understanding the physics of optical modulators and its applications	K1	Lectures	Final Exam M.T. Exam HW, QZ
2.0	**Skills**			
2.1	Demonstrates an ability to identify reasonable assumptions that could or should be made before a solution path is proposed.	S1	Lectures	Projects
2.2	Demonstrates an ability to identify a range of suitable engineering fundamentals (including mathematical techniques) that would be potentially useful for analyzing a technical problem.	S1, S2	Lectures	Projects
2.3	Obtains substantiated conclusions as a result of a problem solution including recognizing the	S1	Lectures	Projects

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	limitations of the solutions.			
3.0	**Values, autonomy, and responsibility**			
3.1	Critically evaluates and applies knowledge, methods and skills procured through self-directed and self-identified sources, including those that lie outside the nominal course curriculum.	V1, V2	Lectures	Projects
3.2				
...				

C. Course Content:

No	List of Topics	Contact Hours
1.	Overview and optical process Section 1, 2; Chapter 1, 2	4
2.	Amplification and optical resonator Section 2, 4; Chapter 4, 5	5
3.	Longitudinal and transverse modes Section 3, 4; Chapter 3, 4	4
4.	Laser performance Section 4; Chapter 5	3
5.	Types of lasers Section 6; Chapter 10	3
6.	Types of lasers, amplifiers Section 6; Chapter 9, 10, 12	4
7.	Plan wave, refractive index Section 7, 8; Chapter 3 – Syms, Chapter 8	5
8.	Anti-reflection coating, negative refractive index, plasmonics Section 8, 10, 11; Chapter 3	3
9.	Light propagation in a medium, index ellipsoid, Pockels effect Section 9; Chapter 2, 3 – Syms; Chapter 3-4, 7-12	5
10.	Optical waveguide, modulators Section 12	4
11.	Project presentations	5
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	HW 1	Week 2	2%
2.	Quiz 1	Week 3	5%
3.	HW 2	Week 4	2%
4.	Quiz 2	Week 5	5%
5.	HW 3	Week 6	2%
6.	Exam1	Week 8	25%
7.	HW 4	Week 10	2%
8.	Quiz 3	Week 12	5%
9.	HW 5	Week 13	2%
10.	Project or research paper	Week 15	20%
11.	Final comprehensive exam	Week 16	30%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	Kelin J. Kuhn, “laser engineering”, Prentice-Hall, 1998
Supportive References	1. Richard Syms and John Cozens, "Optical Guided Waves and Devices", McGraw Hill, 1993; 2. Frank L. Pedrotti, S. J. Leno S. Pedrotti, "Introduction to Optics", Prentice Hall, 1993; 3. Amnon Yariv, "Optical Electronics in Modern Communications", New York, Oxford, Oxford University Press,
Electronic Materials	IEEE Xplore
Other Learning Materials	Optical simulation tools and Other reading material by the instructor.

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom meeting twice a week (1 hour and half each lecture)
Technology equipment (Projector, smart board, software)	Blackboard and BPM software, other simulation software

Items	Resources
Other equipment (Depending on the nature of the specialty)	Optical demonstration tools

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Online student evaluation and CLO survey
Effectiveness of students' assessment	NA	NA
Quality of learning resources	Students	Program Evaluation Surveys
The extent to which CLOs have been achieved	Students	CLO evaluation in the course assessment report
Other	None	None

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**EE DEPARTMENT QUALITY COMMITTEE**
REFERENCE NO.	**MEETING # 10**
DATE	**APRIL 19, 2025**