Course Specification

(Postgraduate Programs)

Course Title:	Optoelectronics
Course Code:	2202-572
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 3/2nd year					
4. Course General Description:					
This course provides an overview of Optoelectronic devices and the physics that governs their operation: Optics in semiconductors: Theory and design of lasers, photo-detectors, solar cells, and modulators. Applications of optoelectronic devices to fiber optic communications.					
5. Pre-requirements for this course (if any)**:**					
2202-243 (Electronics I) 2202-331 (Engineering Electromagnetism) 2202-493 (Fiber Optics Communications)					
6. Co-requisites for this course (if any)**:**					
2202-575					
7. Course Main Objective(s):					
Advanced knowledge on the theory and design of Photonic 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 • Traditional classroom • E-learning		
4	Distance learning		

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

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Assignments**	20
3.	**Library**	10
4.	**Projects/Research Essays/Theses**	30
5.	**Others (specify)……**	
	Total	90 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	Apply the fundamentals of semiconductor devices	K1	Powerpoint lectures with clear illustrations and solved examples. Practice problems and homework assignments	Quizzes, Midterm, H.W and Final
1.2	Define absorption in bulk semiconductors	K1		
1.3	Recognize quantum confinement and absorption in quantum wells	K1		
1.4	Describe Optical amplifiers	K1		
2.0	**Skills**			
2.1	Analyze optical amplifier population inversion, gain, and recombination	S1	Powerpoint lectures with clear illustrations and solved examples. Practice problems and homework assignments.	Quizzes, midterm, H.W and final Exam questions that require thinking and analysis s also
2.2	Explain Fabry-Perot resonators, lasing threshold.	S1		

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
2.3	Explain the application of optoelectronics in optical communication	S1		help assess student's skills
2.4	Design semiconductor photonic devices	S2	Project or term paper in which a student is assigned a topic that covers the course material.	Research paper marks or a project
3.0	**Values, autonomy, and responsibility**			
3.1	Design semiconductor photonic devices	V1	Project or term paper in which a student is assigned a topic that covers the course material.	Research paper marks or a project
3.2	Acquire lifelong experience in doing projects related to optoelectronics.	V3	Project or term paper in which a student is assigned a topic that covers the course material.	Research paper marks or a project
...				

C. Course Content:

No	List of Topics	Contact Hours
1.	Background: carrier distributions, pn junctions, carrier injection	6
2.	Photodetectors: absorption in bulk semiconductors, displacement currents, gain-bandwidth limits	6
3.	Modulators: absorption in quantum wells, quantum confined Stark effect	6
4.	Optical amplifiers: population inversion and gain, recombination	8
5.	coupled electron-photon rate equations, gain saturation, optical confinement	7
6.	Lasers: Fabry-Perot resonators, lasing threshold	4

7.	Heterostructure materials: optical and electrical properties of alloys, heterostructure	5
8.	Fiber optic communication	3
	Total	**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes	One every three weeks	15%
2.	Midterm Exam	Week 9	25%
3.	Homeworks	One every three weeks	10%
4.	Project or term paper	Week 14	30%
5.	Final Exam	Week 16	25%

*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	1. Wilson, and Hawkes, "Optoelectronics: An Introduction", 3rd Edition, (1998), ISBN-13: 978-0131039612. 2. Aruna Tripathy, "Optoelectronics And Systems", Studium Press June 2017, ISBN: 9789387813588
Supportive References	1. Emmanuel Rosencher, "Optoelectronics", 10th edition, Ecole Polytechnique, Paris, 2002, ISBN: 978052177129
Electronic Materials	1. IEEE Lightwave Technology. 2. IEEE Photonics 3. IET Photonics 4. Texas Instruments: www.ti.com/ 5. NXP semiconductor: www.nxp.com/
Other Learning Materials	None

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Number of seats in classroom : 20 • Projector and Data show: 1 • Board: 1

Items	Resources
Technology equipment (Projector, smart board, software)	• FlexPDE • BPM • MatLab
Other equipment (Depending on the nature of the specialty)	Whiteboard

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect- Online Survey
Effectiveness of students' assessment	Students and Faculty	Direct and Indirect Assessment
Quality of learning resources	Students and Faculty	Indirect- Online Survey
The extent to which CLOs have been achieved	Students and Faculty	Direct and Indirect Assessment
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**