هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

Course Specifications

Course Title:	**PHOTONICS**
Course Code:	**2034223-3**
Program:	**Bachelor in Physics**
Department:	**Physics Department**
College:	**College of Science**
Institution:	**Taif University**

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A. Course Identification

1. Credit hours:	**3**
2. Course type	
a.	University ☐ College ☑ Department ☐ Others ☐
b.	Required ☐ Elective ☑
3. Level/year at which this course is offered:	**12th Level / 4th Year**
4. Pre-requisites for this course (if any)**:**	**None**
5. Co-requisites for this course (if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	4	100%
2	**Blended**	0	0%
3	**E-learning**	0	0%
4	**Distance learning**	0	0%
5	**Other**	0	0%

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	40
2	**Laboratory/Studio**	0
3	**Tutorial**	0
4	**Others** (specify)	0
	Total	40

B. Course Objectives and Learning Outcomes

1. Course Description

This course provides students with a working knowledge of optical physics, including diffraction and physical optics, atomic physics and optical spectroscopy, laser physics and photonics. It also provides a basis for further study in optics and photonics. Content will include: Optical fibres, microstructured optical fibres, fibre Bragg gratings, fibre sensors, optical materials, photonic crystals. Lorentz electron oscillator and dispersion, Fresnel equations and multi-layer dielectric coatings, polarisation and birefringence. Fresnel-Kirchhoff integral and diffraction, Fourier optics, Abbe's theory of imaging, image processing. Lasers; Einstein equations, stimulated and spontaneous emission and absorption, optical amplification, resonators and modes, rate equations, pulsed and continuous lasers, mode-locked lasers.

2. Course Main Objective

This course aims at providing students with the systematic introduction to the concepts of modern photonics (the application and use of light in modern technologies) and subsystems for applications in optical communications, optical sensing and imaging, optical data-storage and computing and solid-state illumination.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Explain the concept of light propagation and guided-wave in different media	K1
1.2	Recall the properties and applications of photonic devices including lasers, modulators and detectors	K3
2	**Skills :**	
2.1	Design an optical system for communications.	S1
2.2	Combine previously acquired knowledge and skills in mathematics, solid state physics, electromagnetism and optics with new theory to analyze and design the practical photonic components and systems	S1
3	**Values:**	
3.1	Show responsibility for working independently and for continuous improvement of personal capacities.	V1

C. Course Content

No	List of Topics	Contact Hours
1	Nature of light and how it is manipulated	3
2	Basic Geometrical Optics and Physical Optics	4
3	Optical Waveguides	3
4	Fiber Optic Communications	5
5	Optical Resonators and Optical Amplifiers	4
6	Photonic Sources: Light Emitting Diode (LED) and Semiconductor Lasers	5
7	Light Processing Devices	4
8	Detection of Light Radiation and Optical Receivers	4
9	Light Modulation Techniques	3
10	Photonic Devices and Applications	5
Total		40

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	Explain the concept of light propagation and guided-wave in different media	Lecture	Written exam and Homework reports
1.2	Recall the properties and applications of photonic devices including lasers, modulators and detectors	Lecture and Group discussion	Written exam
2.0	**Skills**		
2.1	Design an optical system for communications.	Lectures	Written exam and Homework reports
2.2	Combine previously acquired knowledge and skills in mathematics,	Lecture and Group discussion	Homework reports

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	solid state physics, electromagnetism and optics with new theory to analyze and design the practical photonic components and systems		
3.0	**Values**		
3.1	Show responsibility for working independently and for continuous improvement of personal capacities.	Group discussion	Project

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Assignments and Interaction during lectures	continuous	10%
2	Midterm exam	6th	30%
3	Short exam	9th	10%
4	Final exam	12th	50%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- Each faculty member is assigned a group of students for continuous academic advice during six weekly office hours (6 hrs./week).
- Also teaching staff are available for individual student consultations during this period.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1- B.E.A. Saleh and M.C. Teich, Fundamentals of Photonics, Second Edition 2007 (Third Printing, January 2009) (Wiley-Interscience). 2- A. Yariv, , and P. Yeh. Photonics: optical electronics in modern communications. Vol. 6. New York: oxford university press, 2007.
Essential References Materials	1- R. Boyd, . Nonlinear optics, Handbook of Laser Technology and Applications (Three-Volume Set). Taylor & Francis, 2003. 161-183. 2- Fundamentals of Photonics: spie.org/x17229.xml
Electronic Materials	1. http://www.rp-photonics.com/encyclopedia.html 2. http://ocw.mit.edu/resources/res-6-006-video-demonstrations-in-lasers-and-optics-spring-2008/index.htm
Other Learning Materials	1- MATLAB software. 2- Mathematica software

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	- Lecture room with max 50 seats.
Technology Resources (AV, data show, Smart Board, software, etc.)	- Computer room containing at least 10 stations - Software (MATLAB, Mathematica, Origin ……) data show, Smart Board, software
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Not applicable for this course

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Student Feedback on Effectiveness of Teaching	Students	Indirect
Evaluation of Teaching	Pear reviewer Program coordinator Departmental council Faculty council	Indirect
Improvement of Teaching	Program coordinator Relevant committee	Direct
Quality of learning resources	Students Instructor Faculty	Indirect
Extent of achievement of course learning outcomes,	Program coordinator Instructor	Direct
Course effectiveness and planning for improvement	Program coordinator Instructor	Indirect

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	October 2, 2022