هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

T-104
2022

Course Specification

Course Title: Physics - Optics
Course Code: PHYS 331
Program: B.Sc. in Physics
Department: Department of Physics and Astronomy
College: College of Science
Institution: King Saud University
Version: 2.0.0
Last Revision Date: Sep 2023

Table of Contents:

A. General information about the course:

Course Identification					
1. Credit hours:	3(3+0+0)				
2. Course type					
a.	University ☐	College ☐	Department☒	Track☐	Others☐
b.	Required ☒	Elective☐			
3. Level/year at which this course is offered:	fifth level / third year				

4. Course general Description

The course has been designed to explain the basic principles of optics. The student realizes, at the beginning, the meaning of wave equations (including one-dimensional wave equation, harmonic waves, complex representation, plane waves, and electromagnetic waves). After that, superposition of waves (including superposition principle, superposition of waves of the same frequency, random and coherent sources, standing waves, the beat phenomenon, phase and group velocities) is introduced. Furthermore, the concept of the interference (including two-beam interference, Young's double-slit experiment, double-slit interference with virtual sources, interference in dielectric films, fringes of equal thickness, and Newton's rings) and optical interferometry are introduced. Consequently, diffraction of light (including types of diffraction, Fraunhofer diffraction, beam spreading, rectangular and circular apertures, resolution, double-slit diffraction, and diffraction from many slits) and the diffraction grating (including the grating equation, free spectral range, dispersion, resolution, types of grating, and grating instruments) are explained. In the last part of the course, the students should know the meaning of polarization and realizes the production of polarized light (including polarization by selective absorption, polarization by reflection from dielectric surfaces, polarization by scattering, birefringence, double refraction, optical activity, and photoelasticity).

5. Pre-requirements for this course (if any): PHYS 230

6. Co- requirements for this course (if any): N/A

7. Course Main Objective(s)

1. The students should be able to understand and express wave theory of light and its applications.
2. The students should be aware and deal with some basic optical instruments.
3. The students learn the problem-solving in optics and light, help them to improve their skills.

1. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1.	Traditional classroom	45	100%
2.	E-learning	0	0
3.	Hybrid • Traditional classroom • E-learning	0	0
4.	Distance learning	0	0

2. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	45
2.	Laboratory/Studio	0
3.	Field	0
4.	Tutorial	0
5.	Others (specify)	0
	Total	45

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

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Describe the concepts of wave theory of light and Superposition of waves	K1	• Give extensive examples during lecture. • Give problem sheets to be discussed during lecture.	• Contribution during Lectures. • Midterm and Final Exam. • Homework's and open book Exam.
1.2	Recognize interference, diffraction and polarization of light	K2		
2.0	Skills			
2.1	Apply the concepts of superposition, interference and diffraction to solve problems	S1	• Analysis, capability for creative thinking, problem identification. • Solving homework assigned to students.	• Quick questions. • Adopting quizzes or fast exam.
2.2	Reorganize the most famous and useful instruments	S2		

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	build on the studied optics		• Solving selected problems inside the class.	
3.0	Values, autonomy, and responsibility			
3.1	Illustrate optical instruments and its application	V1	Learn how to: • search the internet and use the library. • cover missed lectures. • summarize lectures. • collect materials of the course. • solve difficulties in learning. • enhance educational skills.	• Exams. • Take-home assignments. • Quizzes on the previous lecture. • Checking report on internet use.
3.2	Using Mathematical software to simulate the optics problem	V2		

C. Course Content

No	List of Topics	Contact Hours
1.	**Wave Equations:** One-Dimensional Wave Equation, Harmonic Waves, Complex Numbers, Harmonic Waves as Complex Functions, Plane Waves, Electromagnetic Waves.	5
2.	**Superposition of Waves:** Superposition Principle, Superposition of Waves of the Same Frequency, Random and Coherent Sources, Standing Waves, The Beat Phenomenon, Phase and Group Velocities.	5
3.	**Interference of Light:** Two-Beam Interference, Young's Double-Slit Experiment, Double-Slit Interference with Virtual Sources, Interference in Dielectric Films, Fringes of Equal Thickness, Newton's Rings, Film-Thickness Measurement by Interference, Multiple-Beam Interference in a Parallel Plane.	9
4.	**Optical Interferometry:** The Michelson Interferometer, The Fabry-Perot Interferometer, Gravitational Wave Detectors.	3
5.	**Fraunhofer Diffraction:** Diffraction from a Single Slit, Beam Spreading, Rectangular and Circular Apertures, Resolution, Double-Slit Diffraction, Diffraction from Many Slits.	8
6.	**The Diffraction Grating:** The Grating Equation, Free Spectral Range of a Grating, Dispersion of a Grating, Resolution of a Grating, Types of Gratings, Grating Instruments.	6
7	**Production of Polarized Light:** Polarization by Selective Absorption, Polarization by Reflection from Dielectric Surfaces, Polarization by Scattering, Birefringence: Polarization with Two Refractive Indices, Double Refraction, Optical Activity, Photoelasticity.	9
	Total	45

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	First Midterm examination	Approx. 6	15%
2.	Second Midterm examination	Approx. 12	15%
3.	Homework	Weekly	20%
4.	Attendance and participation	daily	10%
5.	Final examination	From 16 to 18	40%

*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	Introduction to Optics, 3rd Edition (by J. Pedrotti, Leno M, Leno S. Pedrotti)
Supportive References	Optics, 4th Edition (by E. Hecht) المدخل الى البصريات (ترجمة عبدالله الضويان و محمد الصالحي)
Electronic Materials	None
Other Learning Materials	Internet sites relevant to the course

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	A classroom which accommodates 25 students.
Technology equipment (projector, smart board, software)	Computer, projector, smart board, and whiteboard.
Other equipment (depending on the nature of the specialty)	Animated Optical illustration

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students\ Peer Reviewer	Indirect \ direct
Effectiveness of students assessment	Students- Faculty	Direct
Quality of learning resources	students	Indirect
The extent to which CLOs have been achieved	Faculty	Indirect

Assessment Areas/Issues	Assessor	Assessment Methods
Other	None	None

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval Data

COUNCIL /COMMITTEE	Physics Department's council
REFERENCE NO.	9th (1st term/1445)
DATE	14/06/1445