هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	Physical Optics
Course Code:	**312PHYS**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan University**

Table of Contents

A. Course Identification

1. Credit hours: 4
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: Level5/Year3
4. Pre-requisites for this course (if any)**:211PHYS (Geometrical Optics)**
5. Co-requisites for this course (if any)**:NIL**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	42	55%
2	Blended	6	7%
3	E-learning		
4	Distance learning		
5	Other (lab)	27	37%

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	45
2	Laboratory/Studio	30
3	Tutorial	--
4	Others (specify)	--
	Total	75

B. Course Objectives and Learning Outcomes

1. Course Description

The course provides background knowledge of several optics phenomena with an emphasis on the light as electromagnetic waves. It covers the concepts of superposition, interference, diffraction and polarization of light. The course also covers applications and experiments related to these concepts. The course material will be covered in traditional lecture format as well as laboratory demonstrations and hands-on activities.

2. Course Main Objective

The concept of the nature of light and wave theory of light.
- The concept of superposition of light
- The interference of light and related experiments.
- The principles of the diffraction of light for many cases and diffraction grating.
- The principles of polarization of light.
- Hands on experience in the laboratory experiments to understand the related concepts

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**Recall** the superposition of waves, the wave velocity, and the group velocity, difference between interference and diffraction and their types as well as the light polarization and its various methods	**PLO1.1**
1.2	**Define** the concepts of Huygens's principle, interference and diffraction of light, superposition of waves, and its applications, and calculate the aspects of the polarization of light, the birefringence, the Brewster's angle and polarization by reflection	**PLO1.1**
1.3	**Discuss** various types of interference, various types of diffraction as well as various types of polarization	**PLO1.2**
2	**Skills :**	
2.1	**Solve** various problems related to interference and diffraction such as the film thickness by interference and conditions of maxima and minima for interference in films, fringes of equal thickness Newton's Rings, and Michelson interferometer, double slit interference, and single, double and multi slit diffraction	**PLO2.1**
2.2	**Derive** the expression for irradiance of light for double slit interference, single, double and multi slit diffraction.	**PLO2.2**
2.3	**Perform experiments** about interference in Young's double slit, diffraction from single and double slit, and hair, thickness, Newton's Rings, Michelson interferometer, and Malus' law of polarization, Optical activity and polarization and analyze their related data	**PLO2.3**
2.4	**Develop** competencies in critical thinking, communication and writing lab reports.	**PLO2.4**
3	**Values:**	
3.1	**Demonstrate** abilities to work in groups and bear individual responsibility during lab work, interactive discussion and group assignments.	**PLO3.1**
3.2	**Show** awareness of safety for own and others when dealing with lab equipment's	**PLO3.3**
3.3		
3...		

C. Course Content

Theoretical Part

No	List of Topics	Contact Hours
1	**Nature of light and wave theory of light** - Concept of light as a particle - Concept of light as a wave - Concept of light as an electromagnetic wave	4
2	**Vibrations and waves** - Simple harmonic motion (SHM) - Transverse wave - Wave velocity	**4**
3	**Superposition of waves** - Addition of SHM - Superposition of two waves - Superposition of many waves - Group velocity	**6**

4	**Interference of light** - Huygens' principle - Young's experiment - Thin film interference - Film thickness by interference - Newton's ring - Others interferometers apparatuses	**12**
5	**Diffraction of light** - Single slit diffraction - Resolving power - Diffraction grating - Rayleigh's criterion - Fraunhofer diffraction - Double slit diffraction - Diffraction from many slits - Diffraction grating - Fresnel diffraction	**10**
6	**Polarization of light** - State of polarization and polarizer - Malus' law - Dichroism - Birefringence - Brewster's angle - Polarization by reflection	**6**
7	**Review**	**3**
Total		**45**

Experimental Part:

No	List of Topics	Contact Hours
1	**Interference of light using Young's double-slit**	**2**
2	**Diffraction of light through a single-slit**	**2**
3	**Diffraction grating spectrometer**	**2**
4	**The diameter of a Human Hair by Laser Diffraction**	**2**
5	**Michelson interferometer**	**2**
6	**Newton's interference rings**	**2**
7	**Malus' law of polarization**	**2**
8	**Optical activity and polarization**	**2**
9	**Brewster's angle**	**2**
10	**Kerr effect**	**2**
	Introduction, review, and various exams	**10**
Total		**30**

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	**Recall** the superposition of waves, the wave velocity, and the group velocity, difference between interference and diffraction and their types as well as the light polarization and its various methods	Lectures, blackboard and visualization, group and interactive guided discussion, Interactive discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
1.2	**Define** the concepts of Huygens's principle, interference and diffraction of light, superposition of waves, and its applications, and calculate the aspects of the polarization of light, the birefringence, the Brewster's angle and polarization by reflection	Lectures, blackboard and diagram illustration, group discussion, Interactive illustrations- Student contribution	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
1.3	**Discuss** various types of interference, various types of diffraction as well as various types of polarization	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
2.0	**Skills**		
2.1	**Solve** various problems related to interference and diffraction such as the film thickness by interference and conditions of maxima and minima for interference in films, fringes of equal thickness Newton's Rings, and Michelson interferometer, double slit interference, and single, double and multi slit diffraction	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
2.2	**Derive** the expression for irradiance of light for double slit interference, single, double and multi slit diffraction.	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
2.3	**Perform experiments** about interference in Young's double slit, diffraction from single and double slit, and hair, thickness, Newton's Rings, Michelson interferometer, and Malus' law of polarization, Optical activity and polarization and analyze their related data	Hands on lab demonstrations- guided discussion – guided discovery	**Direct** (formative and summative):Evaluation of assignments, Step-by-step checkpoint assessment of experiment, In lab

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
			interactive questioning, quizzes, written exams **Indirect:** student survey
2.4	**Develop** competencies in critical thinking, communication and writing lab reports.	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
3.0	**Values**		
3.1	**Demonstrate** abilities to work in groups and bear individual responsibility during lab work, interactive discussion and group assignments.	Interactive and Group discussion, expository and discovery teaching	**Direct** (formative and summative): In lab interactive questioning **Indirect**: student survey
3.2	**Show** awareness of safety for own and others when dealing with lab equipment's	Case study-interactive demonstration-guided discussion	**Direct** (formative and summative): In lab interactive questioning **Indirect**: student survey
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2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Homework assignment- Contribution in interactive discussion**	**2**	**2 (2%)**
2	**Quiz 1**	**3**	**2 (2%)**
3	**First Mid-term exam**	**7**	**10 (10%)**
4	**Homework assignment- Contribution in interactive discussion**	**8**	**2 (2%)**
5	**Quiz 2**	**9**	**2 (2%)**
6	**Second mid-term exam**	**11**	**10 (10%)**
7	**Homework assignment- Contribution in interactive discussion- Group work-essay or Project discussion**	**12**	**2 (2%)**
8	**Laboratory Exam**	**14**	**20 (20%)**
9	**Final Exam**	**16**	**50 (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 group of students is assigned to a staff member who will be available for help and academic guidance office hours at specific 2h on daily basis.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Introduction to Optics by Frank L Pedrotti, Leno M Pedrotti , Leno S Pedrotti . Addison-Wesley; 3rd edition (April 17, 2006).
Essential References Materials	Fundamental of Optics; F. A. Jenkins and H. S. White, McGraw-Hill Priml Custom Publishing, 2001. - Optics; Eugene Hecht, 4th Edition, Addison- Wesley, 2001.
Electronic Materials	**http://www.wikipedia.org/** **https://spie.org/** **http://hyperphysics.phy-astr.gsu.edu/**
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	**1 Lecture room(s) for groups of 50 students.** **- 1 Laboratory for group of 25 students.**
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show- smart board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation

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	**Department council**
Reference No.	**8**
Date	**16/4/1442**