هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

# Course Specifications

| | |
|---|---|
| **Course Title:** | **Optics (2)** |
| **Course Code:** | **PHY4404** |
| **Program:** | **B.Sc. Degree in Physics** |
| **Department:** | **Physics** |
| **College:** | **Applied Sciences** |
| **Institution:** | **Umm Al-Qura University** |

## Table of Contents

## A. Course Identification

| | |
|---|---|
| 1. Credit hours: 4 | |
| 2. Course type<br>a. University ☐ College ☐ Department ☑ Others ☐<br>b. Required ☑ Elective ☐ | |
| 3. Level/year at which this course is offered: Level 10 / Year 4 | |
| 4. Pre-requisites for this course (if any): Optics (1) | |
| 5. Co-requisites for this course (if any): | |

**6. Mode of Instruction** (mark all that apply)

| No | Mode of Instruction | Contact Hours | Percentage |
|---|---|---|---|
| 1 | Traditional classroom | 30 | 80% |
| 2 | Laboratory | 30 | 20% |
| 3 | E-learning | | |
| 4 | Distance learning | | |
| 5 | Other | | |

**7. Contact Hours** (based on academic semester)

| No | Activity | Contact Hours |
|---|---|---|
| 1 | Lecture | 30 |
| 2 | Laboratory | 30 |
| 3 | Tutorial | |
| 4 | Others (specify) | |
| | Total | 60 |

## B. Course Objectives and Learning Outcomes

### 1. Course Description

This course treats light as waves. It interprets optical phenomena like interference, diffraction, and polarization in terms of wave-optics.

### 2. Course Main Objective

The course undertakes optics from the point of view of waves. It interprets phenomena like interference, diffraction, and polarization in terms of wave behavior. The course introduces and explains interference (single and double), diffraction (Fresnel and Fraunhofer) as well as polarization and relation to the matter.
The mathematical treatment related to these phenomena is described and derived.

### 3. Course Learning Outcomes

| | CLOs | Aligned-PLOs |
|---|---|---|
| 1 | **Knowledge and Understanding** | |
| 1.2 | Define the concepts of interference, diffraction, and polarization in terms of waves optics | K1 (M) |
| 1.3 | Describe physical laws governing wave-optics phenomena | K2 (M) |
| **2** | **Skills :** | |
| 2.1 | Solve interference and diffraction problems | S1 (P) |
| 2.2 | Explain the scientific theoretical procedures governing light behavior in terms of wave optics. | S2 (P) |
| **3** | **Values:** | |
| 3.1 | Collaborate and contribute responsibly and effectively in teamwork | V2 (P) |

## C. Course Content

| No | List of Topics | Contact Hours |
|---|---|---|
| 1 | **Fraunhofer Diffraction**<br>• Fresnel and Fraunhofer Diffraction<br>• Diffraction by a Single Slit<br>• Rectangular Aperture<br>• Circular Aperture<br>• The Double Slit | 5 |
| 2 | **The Diffraction Grating**<br>• Effect of Increasing the Number of Slits<br>• Intensity Distribution from an Ideal Grating<br>• Principal Maxima<br>• Minima and Secondary Maxima<br>• Formation of Spectra by a Grating<br>• Dispersion<br>• Resolving Power | 5 |
| 3 | **Fresnel Diffraction**<br>• Fresnel's Half-Period Zones<br>• Diffraction by a Circular Aperture<br>• Diffraction by a Circular Obstacle<br>• Fresnel's Integrals<br>• The Straight Edge<br>• Rectilinear Propagation of Light<br>• SingleSlit | 5 |
| 4 | **The Polarization of Light**<br>• Polarization by Reflection<br>• Polarizing Angle and Brewster's Law<br>• Law of Malus<br>• Polarization by Dichroic Crystals<br>• Double Refraction<br>• Optic Axis<br>• Nicol Prism<br>• Polarization by Scattering | 5 |
| 5 | **Introduction to Laser**<br>• Spontaneous, Absorption and Stimulated Emission | 10 |

| | | |
|---|---|---|
| | • Properties of Laser Beams<br>• Types of Lasers<br>• Energy Levels, Radiative and Nonradiative Transitions<br>• Optical Resonators<br>• Pumping Processes<br>• Continuous Wave Laser Behavior | |
| 6 | **Practical Part:**<br>• Students will conduct various experiments in the practical part of the course. Each student will perform the experiment, collect data, extract result, and prepare a written report every week. | 10 |
| **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 | Define the concepts of interference, diffraction, and polarization in terms of waves optics | Demonstrating the basic information and principles through lectures and discussions. | Homework and Mid and final exams. |
| 1.2 | Describe physical laws governing wave-optics phenomena | | |
| **2.0** | **Skills** | | |
| 2.1 | Solve interference and diffraction problems | Lecturing, discussion, and problem-solving. | Homework and Mid and final exams |
| 2.2 | Explain the scientific theoretical procedures governing light behavior in terms of wave optics. | | |
| **3.0** | **Values** | | |
| 3.1 | Collaborate and contribute responsibly and effectively in teamwork | presentations and discussion groups | Presentations and seminars |

### 2. Assessment Tasks for Students

| # | Assessment task* | Week Due | Percentage of Total Assessment Score |
|---|---|---|---|
| **1** | Mid-Term Exam | 11 | 20% |
| **3** | Homework and Quizzes | During term | 10% |
| **4** | Lab. Reports and Exam | During term | 20% |
| **5** | Final Exam | End of the term | 50% |

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

## E. Student Academic Counseling and Support

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| **Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :**<br>Consultation and/or academic advice will be available during the teaching staff office hours |

## F. Learning Resources and Facilities

### 1. Learning Resources

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|---|---|
| **Required Textbooks** | 1. Francis A. Jenkins and Harvey E. White, “Fundamentals of Optics”, 4th Edition, McGraw-Hili Primls, (2001). |

| | |
|---|---|
| | 2. Orazio Svelto and David C. Hanna, "Principles of Lasers", 5th Edition, Springer, (2010). |
| **Essential References Materials** | |
| **Electronic Materials** | |
| **Other Learning Materials** | |

**2. Facilities Required**

| Item | Resources |
|---|---|
| **Accommodation** (Classrooms, laboratories, demonstration rooms/labs, etc.) | 1. Classroom<br>2. Optics Laboratory |
| **Technology Resources** (AV, data show, Smart Board, software, etc.) | data show |
| **Other Resources** (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list) | |

## G. Course Quality Evaluation

| Evaluation Areas/Issues | Evaluators | Evaluation Methods |
|---|---|---|
| Effectiveness of Teaching | Students | Questionnaires |
| Achievement of course learning outcomes | Program Leader | Course Report |

**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

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|---|---|
| **Council / Committee** | |
| **Reference No.** | |
| **Date** | |