



Course Specifications

| | |
|----------------------|---------------------------|
| Course Title: | Geometrical Optics |
| Course Code: | 211PHYS |
| Program: | Physics |
| Department: | Physics |
| College: | Science |
| Institution: | Jazan University |

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A. Course Identification

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|--|
| 1. Credit hours: 3 |
| 2. Course type |
| a. University <input type="checkbox"/> College <input type="checkbox"/> Department <input checked="" type="checkbox"/> Others <input type="checkbox"/> |
| b. Required <input checked="" type="checkbox"/> Elective <input type="checkbox"/> |
| 3. Level/year at which this course is offered: Level 4/ Year 2 |
| 4. Pre-requisites for this course (if any): NIL |
| 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 | 28 | 47% |
| 2 | Blended | 6 | 10% |
| 3 | E-learning | | |
| 4 | Distance learning | | |
| 5 | Other | 26 | 43% |

7. Contact Hours (based on academic semester)

| No | Activity | Contact Hours |
|----|--|---------------|
| 1 | Lecture | 30 |
| 2 | Laboratory/Studio | 30 |
| 3 | Tutorial | 0 |
| 4 | Others (specify) Preparations for various assignments, Quizzes, exams and office hours | 40 |
| | Total | 100 |

B. Course Objectives and Learning Outcomes

1. Course Description

This course is designed to provide students with the basic principal of geometrical optics covering reflection and refraction by a plane and spherical surfaces, prisms, optical fibers, lenses as well as the optical instruments; like camera, human eyes, telescopes and microscopes. The laboratory explores geometrical optics through some experiments in refraction, prism, converging and diverging lenses, convex and concave mirrors and some optical instruments.

2. Course Main Objective

This course is designed to provide students with:

- The concept of light
- The foundations of Geometrical optical
- The principal of elementary optical systems
- The concept of image in optical instruments
- The laboratory work and hands-on activities in geometrical optics.

3. Course Learning Outcomes

| CLOs | | Aligned PLOs |
|------|---|--------------|
| 1 | Knowledge and Understanding | |
| 1.1 | Recall nature of light, index of refraction, reflection, refraction law through plan and spherical surface, optical fibers, and dispersion of light through a prism, thin lenses, human eye and the optical instruments. | PLO1.1 |
| 1.2 | Describe the Principle of Reversibility, Fermat's Principle, Huygens principle, lens maker's equation, the total internal reflection, dispersion of light through a prism, image obtained by optical system, the function of the human eye and some optical instruments. | PLO1.1 |
| 2 | Skills : | |
| 2.1 | Solve various problems related to the light, reflection and refraction at spherical and plane surfaces, prisms, thin lenses, mirrors, the human eye and the optical instruments. | PLO2.1 |
| 2.2 | Demonstrate the ability to use ray tracing in studying geometrical optics. | PLO2.2 |
| 2.3 | Perform laboratory experiments in geometrical optics and document their results, using correct procedures and protocols and analyze the obtained data. | PLO2.3 |
| 2.4 | Develop competencies in critical thinking, analyzing the obtained data, communication and writing lab reports. | PLO2.4 |
| 3 | Values: | |
| 3.1 | Develop ability to work in groups and bear individual responsibility during lab work, interactive discussion and group assignments. | PLO3.1 |
| 3.2 | Demonstrate awareness of safety for own and others competencies during lab work. | PLO3.3 |
| 3.3 | | |
| 3... | | |

C. Course Content

Theoretical Part

| No | List of Topics | Contact Hours |
|--------------|--|---------------|
| 1 | Highlights on the optics developments and propagation of light. | 2 |
| 2 | Speed of light and methods of determination of it. | 2 |
| 3 | Reflection and refraction of light. | 2 |
| 4 | Total and Internal reflection of light. | 2 |
| 5 | Fiber optics and their applications. | 2 |
| 6 | Prisms and light dispersion. | 4 |
| 7 | Thin lenses and the formation of images. | 4 |
| 8 | Spherical Mirrors | 2 |
| 9 | Human eye and vision defects. | 3 |
| 10 | Optical Instruments (camera, light microscope and telescope). | 3 |
| 11 | Homework correction, review, and various exams | 4 |
| Total | | 30 |

Experimental Part:

| No | List of Topics | Contact Hours |
|--------------|--|---------------|
| 1 | Color Addition | 2 |
| 2 | Snell's Law (by trapezoid) | 2 |
| 3 | Refractive Index and Critical angle of Glass | 2 |
| 4 | Convex mirror | 2 |
| 5 | Concave mirror | 2 |
| 6 | The focal Length for a convex (converging) lens | 2 |
| 7 | The Focal Length for a Concave Lens | 2 |
| 8 | The equivalent focal length of two convex lenses | 2 |
| 9 | The refractive index of prism using the spectrometer | 2 |
| 10 | Microscope. | 2 |
| 11 | Lab 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 nature of light, index of refraction, reflection, refraction law through plan and spherical surface, optical fibers, and dispersion of light through a prism, thin lenses, human eye and the optical instruments. | Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustrations. | Direct: In class interactive questioning, In class quizzes Homework assignment, Mid-term Final exam Indirect: student survey |
| 1.2 | Describe the Principle of Reversibility, Fermat's Principle, The Huygens principle, lens maker's equation, the total internal reflection, dispersion of light through a prism, image obtained by optical system, the function of the human eye and some optical instruments. | Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustrations | Direct: In class interactive questioning, In class quizzes Homework assignment, Mid-term Final exam Indirect: student survey |
| 2.0 | Skills | | |
| 2.1 | Solve various problems related to the light, reflection and refraction at spherical and plane surfaces, prisms, thin lenses, mirrors, the human eye and the optical instruments. | Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustrations, individual problem solving. | Direct: In class interactive questioning, In class quizzes Homework assignment, Mid-term |

| Code | Course Learning Outcomes | Teaching Strategies | Assessment Methods |
|------------|---|--|---|
| | | | Final exam Indirect: student survey |
| 2.2 | Demonstrate the ability to use ray tracing in studying geometrical optics. | Lectures, blackboard and visualization, group and interactive discussion, Interactive illustrations, Individual ray tracing. | Direct: In class interactive questioning, Homework assignment, Mid-term Final exam Indirect: student survey |
| 2.3 | Perform laboratory experiments in geometrical optics and document their results, using correct procedures and protocols and analyze the obtained data. | Hands on experiment, interactive discussion, discussion, Report | Direct: Assignments, Step-by-step checkpoint assessment of experiment, Final Practical Exam Indirect: student survey |
| 2.4 | Develop competencies in critical thinking, analyzing the obtained data, communication and writing lab reports. | Open dialogue, individual presentation, writing lab report. | Direct: Lab report, Observation, questioning, individual discussion, checking lab report. Indirect: student survey |
| 3.0 | Values | | |
| 3.1 | Develop ability to work in groups and bear individual responsibility during lab work, interactive discussion and group assignments. | Group discussion, group lab work | Direct: Observation, questioning, individual discussion Indirect: student survey |
| 3.2 | Demonstrate awareness of safety for own and others competencies during lab work. | Interactive discussion-Case study, group assignment, open discussion - reviews | Direct: Observation, questioning, discussion-lab report Indirect: student survey |
| ... | | | |

2. Assessment Tasks for Students

| # | Assessment task* | Week Due | Percentage of Total Assessment Score |
|---|-------------------------------------|----------|--------------------------------------|
| 1 | 1 st Homework assignment | 3 | 2 (2%) |
| 2 | Lecture Quiz 1 | 4 | 2 (2%) |
| 3 | 2 nd Homework assignment | 5 | 2 (2%) |
| 4 | First Mid-term exam | 7 | 9 (9%) |
| 5 | 3 rd Homework assignment | 9 | 2 (2%) |

| # | Assessment task* | Week Due | Percentage of Total Assessment Score |
|----|--|----------|--------------------------------------|
| 6 | Lecture Quiz 2 | 10 | 2 (2%) |
| 7 | 4 th Homework assignment | 12 | 2(2%) |
| 8 | Second mid-term exam | 14 | 9 (9%) |
| 9 | Lab Report, communication and lab competence | 14 | 10 (10%) |
| 10 | Final practical exam | 15 | 12 (10%) |
| 11 | 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 (3rd Edition), Pedrotti, Frank L; Pedrotti, Leno M; Pedrotti, Leno S, 2006. |
| Essential References Materials | <ul style="list-style-type: none"> • Modern Optics; Robert D. Guenther, John Wiley & Sons. Inc., 1990. • Optics (4th Edition) Hecht, Eugene. 2001. |
| Electronic Materials | https://en.wikipedia.org/wiki/Geometrical_optics https://www.cliffsnotes.com/study-guides/physics/light/geometrical-optics https://ocw.mit.edu/courses/mechanical-engineering/2-71-optics-spring-2014/lecture-notes/MIT2_71S14_lec2_notes.pdf https://icecube.wisc.edu/~karle/courses/phys202/202lecture22_Ch35.pdf https://phys.libretexts.org/Bookshelves/College_Physics/Book%3A_College_Physics_(OpenStax)/25%3A_Geometric_Optics |
| Other Learning Materials | |

2. Facilities Required

| Item | Resources |
|--|---|
| Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) | Class room for 30 students Geometrical Optics Laboratory for 15 students |
| Technology Resources (AV, data show, Smart Board, software, etc.) | Data show- smart board, Blackboard |

| Item | Resources |
|--|----------------|
| Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list) | Library |

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 | Students and 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 | Council of Physics Department |
| Reference No. | 8 |
| Date | 16/4/1442 |