GE1342: LIGHT: FROM DOUBLE RAINBOWS TO OPTICAL FIBERS

Effective Term
Semester B 2023/24

Part I Course Overview

Course Title
Light: from Double Rainbows to Optical Fibers

Subject Code
GE - Gateway Education
Course Number
1342

Academic Unit
Electrical Engineering (EE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

GE Area (Primary)
Area 3 - Science and Technology

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course aims to guide students through some everyday observations related to light and a number of optical applications. What is a double rainbow? What gives a peacock its fascinating color? Does optical fiber have anything to do with your smart phone? How do blue lasers help the CD industry to stay competitive? This GE course is about light. We survey the wonderful optical phenomena in nature, milestones in optical discoveries over the century, and optical inventions that drastically shaped the modern world. Students will acquire a qualitative appreciation of optics in everyday life through lectures and group presentations.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain and demonstrate optical phenomena in nature such as the rainbow and the blue sky from simple optical principles		x	x	
2	Describe the inventions related to optics such as the optical fiber and lasers as breakthrough discoveries to solve real-life problems			x	x
3	Explain how optical discoveries shaped the modern philosophy in science with new methodologies and devices		x	x	x
4	Describe the impacts of optical inventions in technology, science, and social context			x	

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Large group activity involving the entire class registered on the course where the content pertaining to the particular CILO(s) is presented by the course instructor. The presentation will highlight the main issues concerned with each CILO, as well as the key concepts from each CILO. These will be mixed with broadcasts of selected clips from the wealth of online resources.	1, 2, 3, 4	3 hrs/wk
2	Lab Visits	Visits to the optoelectronic laboratories will be arranged. The guided tour to the high-tech clean room facilities for fabrication of optical devices will be conducted. Hands-on demonstration of representative optical experiments will be illustrated.	1, 2	
3	Group Discussions	Students on the course are organized into groups. In response to the lecture material, each team will huddle for a time of brainstorming and work together on the group-based presentation topic provided by the course instructor. By holding these sessions as part of the curriculum time, guidance is afforded to students in their discussions by the instructor.	1, 2, 3, 4	

4	Group Presentation	Each team presents their findings to the rest of the class. Presentation topics also include group findings of items researched on during a team huddle, some of which are used as formative assessments to provide regular feedback.	1, 2, 3, 4	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Tests (min.: 2)	1, 2, 3, 4	30	
2	#Assignments (min.: 3)	1, 2, 3, 4	30	

Continuous Assessment (%)

60

Examination (%)

40

Examination Duration (Hours)

2

Additional Information for ATs

Remark:
To pass the course, students are required to achieve at least 30% in continuous assessment and 30% in the examination.

#may include homework, tutorial exercise, project/min-project, presentation

Assessment Rubrics (AR)

Assessment Task

Test

Criterion

1. Ability to explain optical phenomena in nature.
2. Ability to describe the inventions of optical devices and systems such as lenses, optical fiber, lasers, etc.
3. Ability to explain how optical discoveries shaped modern philosophy, such as display technologies, solar power, microscopy, etc.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
Presentation and report

Criterion
1. Identify a topic of interest based on the latest discoveries of optical phenomena or the innovations of optical systems.
2. Ability to perform a literature survey on the topic of interest.
3. Ability to present and discuss on the topic of interest.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
Examination

Criterion
1. Ability to explain optical phenomena in nature.
2. Ability to describe the inventions of optical devices and systems such as lenses, optical fiber, lasers, etc.
3. Ability to explain how optical discoveries shaped modern philosophy, such as display technologies, solar power, microscopy, etc.
4. Ability to describe the impacts of optical inventions in technology, science, and social context, such as patents, pollutions, etc.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Part III Other Information

Keyword Syllabus

Optics in the sky
Rainbows, blue sky, dispersion, reflection and refraction, scattering, waves and interference, cameras and lenses, adaptive optics and astronomy.

Optical fibers
History of optical fibers, Prof. Charles Kuen Kao, submarine optical cables, fiber-to-the-home.

Lasers
Einstein and lasers, particle nature of light, blue laser materials, patent issues and lawsuits.

Solar power
Solar cells, photovoltaic materials, efficiency issues, photonic crystals, micro- and nano-structures, butterflies and peacock feathers.

Nanotechnology and Bioimaging
Photonic crystals, synthetic photonic crystals, photonic metamaterials, bright-field microscope, phase contrast microscope, dark-field microscope, fluorescence microscope, confocal microscope.

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Grant R. Fowles, "Introduction to Modern Optics," Dover Books (1989)
2	David R. Falk et al., "Seeing the Light: Optics in Nature, Photography, Color, Vision, and Holography," Wiley & Sons Inc. (1986)
3	Robert D. Guenther, "Modern Optics", Wiley (1990) QC355.2 .G84 1990
4	Eugene Hecht, "Optics", Addison-Wesley (1998) QC355.2 .H42
5	http://science.howstuffworks.com/optics-channel.htm

Annex (for GE courses only)

A. Please specify the Gateway Education Programme Intended Learning Outcomes (PILOs) that the course is aligned to and relate them to the CILOs stated in Part II, Section 2 of this form:

Please indicate which CILO(s) is/are related to this PILO, if any (can be more than one CILOs in each PILO)

PILO 1: Demonstrate the capacity for self-directed learning

1

PILO 2: Explain the basic methodologies and techniques of inquiry of the arts and humanities, social sciences, business, and science and technology

1, 2

PILO 3: Demonstrate critical thinking skills

1, 2, 3, 4

PILO 4: Interpret information and numerical data

1, 2

PILO 6: Demonstrate effective oral communication skills

3, 4

PILO 10: Demonstrate the attitude and/or ability to accomplish discovery and/or innovation

1, 2, 3, 4

B. Please select an assessment task for collecting evidence of student achievement for quality assurance purposes. Please retain at least one sample of student achievement across a period of three years.

Selected Assessment Task

Final examination