

**TISHK INTERNATIONAL UNIVERSITY**  
**FACULTY OF EDUCATION**  
**Department of PHYSICS EDUCATION,**  
**2022-2023 Spring**  
**Course Information for PHYS 320 OPTICS**

|   |  |                    |   |                |             |
|---|--|--------------------|---|----------------|-------------|
| <b>Course Name:</b> OPTICS  |  |                    |   |                |             |
| <b>Code</b>   | <b>Regular Semester</b>  | <b>Theoretical</b> | <b>Practical</b>  | <b>Credits</b> | <b>ECTS</b> |
| PHYS 320  | 6  | 2                  | 2   | 3              | 5           |
| <b>Name of Lecturer(s):</b> Azeez Abdullah Azeez  |  |                    |   |                |             |
| <b>Teaching Assistant:</b> Mr Siver Azeez   |  |                    |   |                |             |
| <b>Course Language:</b> English   |  |                    |   |                |             |
| <b>Course Type:</b> Main  |  |                    |   |                |             |
| <b>Office Hours:</b> Tuesday-Thursday by appointment  |  |                    |   |                |             |
| <b>Contact Email:</b> azeez.abdullah@tiu.edu.iq   |  |                    |   |                |             |
| Tel:07504542010   |  |                    |   |                |             |
| <b>Teacher's academic profile:</b> B.Sc in Physics Salahaddin University-Erbil 1998 M.Sc in Superconductivity Salahaddin University-Erbil 2004 Ph.D in Materials Science Leicester University, Leicester,UK 2014  |  |                    |   |                |             |
| <b>Course Objectives:</b> This course builds on the ideas of harmonic motion to cover in depth the concept of waves in physics with particular emphasis on light waves as an example. The foundation of the course is Fourier theory, which will then be used to understand dispersion of waves, image formation in optics and diffraction and other aspects of Fourier optics. The course material is supported throughout by examples taken from recent research on mechanical systems, nano-optics, atomic physics, biological systems and laser physics. Computer models provide an opportunity to explore various concepts presented in lectures, including models of dispersive waves and wave motion. Complementing the lectures, this course contains a laboratory component. Some experiments are essentially qualitative and support lecture material, while others allow development of important skills in quantitative experimental physics. |  |                    |   |                |             |
| <b>Course Description (Course overview):</b> This course provides students with a working knowledge of optical physics, including diffraction and physical optics, spectroscopy and optical spectroscopy, laser physics and photonics. It also provides a basis for further study in optics and photonics.  |  |                    |   |                |             |
| <b>COURSE CONTENT</b>   |  |                    |   |                |             |
| <b>Week</b>   | <b>Hour</b>  | <b>Date</b>        | <b>Topic</b>  |                |             |
| 1   | 2  | 29/1-2/2/2023      | Introduction  |                |             |
| 2   | 2  | 5-9/2/2023         | The Nature of Light   |                |             |
| 3   | 2  | 12-16/2/2023       | structure of light  |                |             |
| 4   | 2  | 19-23/2/2023       | Speed of Light  |                |             |
| 5   | 2  | 26/2-2/3/2023      | resources of light  |                |             |
| 6   | 2  | 5-9/3/2023         | Reflections and mirrors   |                |             |
| 7   | 2  | 12-16/3/2023       | Refraction and lenses   |                |             |
| 8   | 2  | 19-23/3/2023       | Human eye   |                |             |
| 9   | 2  | 26-30/3/2023       | Wave's optics   |                |             |
| 10  | 2  | 2-6/4/2023         | Midterm Exam  |                |             |
| 11  | 2  | 9-13/4/2023        | Interference  |                |             |
| 12  | 2  | 16-20/4/2023       | Prism   |                |             |
| 13  | 2  | 23-27/4/2023       | Dispersion  |                |             |
| 14  | 2  | 30/4-4/5/2023      | Optical instruments   |                |             |
| 15  | 2  | 7-11/5/2023        | Reflection, Refraction and Interference                                     |                |             |
| 16  | 2  | 14-18/5/2023       | Image Formation, Refractive Index, Optical systems, Prism, Image brightness |                |             |
| 17  | 2  | 21-25/5/2023       | Doppler Effect, Light rays  |                |             |
| 18  | 2  | 28/5-1/6/2023      | Final Exam  |                |             |
| 19  | 2  | 4-8/6/2023         | Final Exam  |                |             |
| <b>COURSE/STUDENT LEARNING OUTCOMES</b>   |  |                    |   |                |             |
| 1   | Appreciate the efficacy of Fourier transforms and their application to physical systems.   |                    |   |                |             |
| 2   | Understand linear, time-invariant systems.   |                    |   |                |             |
| 3   | Understand the role of the wave equation and appreciate the universal nature of wave motion in a range of physical systems                                     |                    |   |                |             |
| 4   | Understand dispersion in waves and model dispersion using Fourier theory.  |                    |   |                |             |
| 5   | Understand diffraction and imaging in terms of Fourier optics and gain physical and intuitive insight in a range of physics via the spatial Fourier Transform. |                    |   |                |             |

**COURSE'S CONTRIBUTION TO PROGRAM OUTCOMES**  
(Blank : no contribution, I: Introduction, P: Profecient, A: Advanced )

| <b>Program Learning Outcomes</b>                           |   | <b>Cont.</b> |               |  |
|--|---|--------------|---------------|--|
| 1  | Discuss concepts and principles of physics.   | P            |               |  |
| 2  | Conduct proper experiments safely and interpret the data in physics teaching physics.   | P            |               |  |
| 3  | Use the results of recent education and subject-specific developmental research when designing, implementing and justifying their own practice as a teacher.  | P            |               |  |
| 4  | Apply analytical and theoretical skills to model and solve physics problems.  | P            |               |  |
| 5  | Identify students' misconceptions and deal with them in classroom.  | P            |               |  |
| 6  | Prepare physics lessons with appropriate learning materials and teaching methods.   | P            |               |  |
| 7  | Effectively assess, plan, teach, organize, and manage physics classrooms.   |              |               |  |
| 8  | Use appropriate methods and techniques to improve students' critical thinking, creative thinking and problem-solving skills in physics.   |              |               |  |
| 9  | Use required modern methods and techniques for student-centered teaching by considering individual and cultural differences of students.  |              |               |  |
| 10   | Effectively use a variety of teaching technologies and techniques and classroom strategies to foster student learning.  |              |               |  |
| 11   | Communicate effectively and work collaboratively within the context of a global society.  |              |               |  |
| 12   | Exhibit character and decision-making skills embodying professionalism and ethical behavior.  |              |               |  |
| <b>Prerequisites (Course Reading List and References):</b> | *Key references: Elementary Wave Optics, 2005, by Robert H. Webb *Useful references: Theoretical Optics: An Introduction, 2005, Hartmann Romer *Magazines and review (internet): <a href="http://www.vision-systems.com/articles/print/volume-6/issue-2/back-to-basics/fundamentals-of-optics-an-introduction-for-beginners.html">http://www.vision-systems.com/articles/print/volume-6/issue-2/back-to-basics/fundamentals-of-optics-an-introduction-for-beginners.html</a>  |              |               |  |
| <b>Student's obligation (Special Requirements):</b>        | 1- Students must turn off all cell phones and pagers when entering any classroom. 2-There will be a homework which is important for developing an understanding of the course material due (almost) every week. All homework has equal weight. You must hand in your own work and put the explanation in your own words. 3- Questions in lecture are always good, and are strongly encouraged. 4- I strongly encourage collaboration, an essential skill in science, by making a presentation writing a report and so on. 5- After each assignment handling there will be a very short quiz covering the material in class. |              |               |  |
| <b>Weekly Laboratory/Practice Plan:</b>                    | <b>Week</b>   | <b>Hour</b>  | <b>Date</b>   | <b>Topics</b>  |
|  | 1   | 2            | 29/1-2/2/2023 | Introduction   |
|  | 2   | 2            | 5-9/2/2023    | Law of distance: (a) To verify the inverse square law. (b) To draw the spectral distribution curve for the given cell.                   |
|  | 3   | 2            | 12-16/2/2023  | 2. Astigmatism.  |
|  | 4   | 2            | 19-23/2/2023  | 3. Study and use of spectrometer: (a) To find the refractive index of the glass of a prism. (b) To study the resolving power of a prism. |
|  | 5   | 2            | 26/2-2/3/2023 | 4. Studying the focal length (a) To measure the focal length of a convex lens. (b) To measure the focal length of a concave mirror.      |
|  | 6   | 2            | 5-9/3/2023    | Lab Review   |
|  | 7   | 2            | 12-16/3/2023  | Midterm Exam   |
|  | 8   | 2            | 19-23/3/2023  | 5.Spherical and chromatic aberrations of a lens.   |
|  | 9   | 2            | 26-30/3/2023  | 6. To measure the power and focal length of concave lens by using convex lens.   |
|  | 10  | 2            | 2-6/4/2023    | 6. To measure the power and focal length of concave lens by using convex lens.   |
|  | 11  | 2            | 9-13/4/2023   | 7. Lambert's law.  |
|  | 12  | 2            | 16-20/4/2023  | 8. To measure the radius of curvature of a mirror or the surface of a lens by means of spherometer.                                      |
|  | 13  | 2            | 23-27/4/2023  | 9. To measure the refractive index of glass and a liquid by the method of real and apparent depth.                                       |
|  | 14  | 2            | 30/4-4/5/2023 | 9. To measure the refractive index of a liquid by the method of real and apparent depth.   |
|  | 15  | 2            | 7-11/5/2023   | 10. To measure the magnification of a microscope.  |
|  | 16  | 2            | 14-18/5/2023  | Law of reflection and refraction.  |
|  | 17  | 2            | 21-25/5/2023  | Law of reflection and refraction.  |
|  | 18  | 2            | 28/5-1/6/2023 | Law of reflection and refraction.  |
|  | 19  | 2            | 4-8/6/2023    | Law of reflection and refraction.  |
| <b>Course Book/Textbook:</b>                               | Optics lab Manual My Lecture notes  |              |               |  |
| <b>Other Course Materials/References:</b>                  | <a href="http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html">http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html</a>   |              |               |  |

|  |   |                                       |                       |
|--|---|---------------------------------------|-----------------------|
| <b>Teaching Methods (Forms of Teaching):</b>   | Lectures, Exercises, Presentation, Seminar, Project, Assignments, , , |                                       |                       |
| <b>COURSE EVALUATION CRITERIA</b>  |   |                                       |                       |
| <b>Method</b>  | <b>Quantity</b>   | <b>Percentage (%)</b>                 |                       |
| Quiz   | 1   | 10                                    |                       |
| Homework   | 1   | 5                                     |                       |
| Project  | 1   | 5                                     |                       |
| Presentation   | 1   | 5                                     |                       |
| Laboratory   | 1   | 10                                    |                       |
| Laboratory   | 1   | 10                                    |                       |
| Lab/Practical Exam(s)  | 1   | 15                                    |                       |
| Final Exam   | 1   | 40                                    |                       |
| <b>Total</b>   |   | <b>100</b>                            |                       |
| <b>Examinations:</b> Essay Questions, True-False, Fill in the Blanks, Multiple Choices, Short Answers, Matching, , , |   |                                       |                       |
| <b>Extra Notes:</b>  |   |                                       |                       |
| <b>ECTS (ALLOCATED BASED ON STUDENT) WORKLOAD</b>  |   |                                       |                       |
| <b>Activities</b>  | <b>Quantity</b>   | <b>Workload Hours for 1 quantity*</b> | <b>Total Workload</b> |
| Theoretical Hours  | 19  | 2                                     | 38                    |
| Practical Hours  | 19  | 2                                     | 19                    |
| Final Exam   | 1   | 2                                     | 2                     |
| Quiz   | 1   | 1                                     | 1                     |
| Homework   | 1   |                                       | 0                     |
| Project  | 1   |                                       | 0                     |
| Presentation   | 1   |                                       | 0                     |
| Laboratory   | 1   |                                       | 0                     |
| Laboratory   | 1   |                                       | 0                     |
| Lab/Practical Exam(s)  | 1   |                                       | 0                     |
| <b>Total Workload</b>  |   |                                       | <b>60</b>             |
| <b>ECTS Credit (Total workload/25)</b>   |   |                                       | <b>2</b>              |

**Peer review**

Signature:  
Name:  
Lecturer

Signature:  
Name:  
Head of Department

Signature:  
Name:  
Dean