Ministry of Higher Education and Scientific research

Department of Physics

College of Education

University of

Salahalddin - Hawler

Subject: Optics Lab.

Course Book – (Year 2)

Lecturer's name: Assist.Prof. Dr. Nahlah Q. Mohammed

Academic Year: 2018/2019

Ministry of Higher Education and Scientific research

Course Book

1. Course name	**Optics Lab.**
2. Lecturer in charge	**Assist. Prof. Dr. Nahlah Qader Mohammed**
3. Department/ College	**Physics/Education**
4. Contact	**Nahlah.mohammed@su.edu.krd**
5. Time (in hours) per week	**3 hours/week**
6. Office hours	**Tuesday 8:30-10:30**
7. Course code	
8. Teacher's academic profile	**https://academics.su.edu.krd/nahlah.mohammed** **B.Sc. (1988-1991) in Physics Department, College of Science, University of Salahaddin / Erbil-Iraq.** **Teaching Assistance (1992-1998) in Physics Department, College of Education, University of Salahaddin / Erbil-Iraq.** **M.Sc. (1998-2000),Physics Department, College of Education, University of Salahaddin / Erbil-Iraq.** **Teaching Staff (2000-2004) in Physics Department, College of Education, University of Salahaddin / Erbil-Iraq.** **Deputy Dean (2000-2004) in College of Nursing, University of Salahaddin / Erbil-Iraq.** **PhD. (2004-2009) in Optoelectronics (Optical Fiber Communications) , Department of Physics, College of Science, University of Baghdad, Baghdad-Iraq.** **Scientific Supervisor of (O.F.C.) Unit in Scientific Research Center (2010-2017), University of Salahaddin / Erbil-Iraq**

Assistant Professor (2017-2019) in Physics Department, College of Education, University of Salahaddin / Erbil-

9. Keywords	**Geometrical Optics and Wave Optics**

10. Course overview:

This course offers instruction in principles of light, reflection, refraction, wave optics and quantum optics. Classes can include lectures as well as a laboratory component. Optical reflection and refraction will be derived, as well as the lens equation and elements of geometrical optics. Optical interference, diffraction, and polarization will be covered in detail, including the role of diffraction in image formation.

Upon completion of this course, students should understand the physical principles underlying geometrical optics, especially the relationship between rays, wavefronts and electromagnetic waves. They should understand how light propagates through "most" optical systems – where "most" refers to optical systems that are not affected by the wave nature of light. They should be able to analyze and design simple optical systems such as telescopes, imagers, luminaires and concentrators. For example, students should be able to:

- Determine the behavior of a ray (reflection/refraction angles and amplitudes) at any optical surface.

 Design an imaging system with a desired resolution, field-of-view and magnification.
 Model a complex optical system using paraxial ray tracing.
 Identify fundamental limits and aberrations in an optical system.

11. Course objective:

The course will give students a better understanding of a number of important phenomenon and topics in optics and will enable the students to:
1- Provide a good foundation in optics
2- Provide knowledge of the behavior of light
3- Inspire interest for the knowledge of concepts in physical and geometrical optics

12. Student's obligation

Students are evaluated through exams and reports.

13. Forms of teaching

Wight board, data show, sheets.

14. Assessment scheme

Grades will be determined by the use of weekly exam. student do Make Experiments Weekly: 15% Quizzes and Laboratory Participation 5% Final Exam: 30%

15. Student learning outcome:

The science learning goals of laboratory experiences include enhancing mastery of science subject matter, developing scientific reasoning abilities, increasing understanding of the complexity and ambiguity of empirical work, developing practical skills, increasing understanding of the nature of science, and improving teamwork abilities. The research suggests that laboratory experiences will be more likely to achieve these goals if they (1) are designed with clear learning outcomes in mind, (2) are thoughtfully sequenced into the flow of classroom science instruction, (3) integrate learning of science content and process, and (4) incorporate ongoing student reflection and discussion..

This is not a complete list of all you will be asked to study and encouraged to learn. However, after successfully completing this lecture and laboratory course you should at least be able to:

1. The student will demonstrate the ability to think critically and to use appropriate concepts to analyze qualitatively problems or situations involving the fundamental principles of optics.

2. The student will demonstrate the ability to use appropriate mathematical techniques and concepts to obtain quantitative solutions to problems in optics.

3. Students will demonstrate basic experimental skills by the practice of setting up and conducting an experiment with due regards to minimizing measurement error.

16. Course Reading List and References:

1- **A Text book of Optics**, N.S. Brijlal, S.Chand & Co. Ltd., New Delhi, 2009.
2- **Physical optics**, A. K. Ghatak Tata McGraw Hill Publishing House Co. Ltd., New Delhi, 2006.
3- **Fundamentals of Optics** by Jenkins A. Francis and White E. Harvey, *McGraw Hill Inc.*

17.Practical Topics	**Experiment Group 1 (Ray Optics)** 1. Law of distance: A. To verify the inverse square law. B. To draw the spectral distribution curve for the given cell. 2. Astigmatism. 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. 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. 5. Spherical and chromatic aberrations of a lens. 6. To measure the power and focal length of concave lens by using convex lens. 7. Lambert's law. 8. To measure the radius of curvature of a mirror or the surface of a lens by means of spherometer.

	9. To measure the refractive index of glass and a liquid by the method of real and apparent depth. 10. To measure the magnification of a microscope. 11. Law of reflection and refraction. **Experiment Group 2 (Wave Optics)** 1. Determine the wave length of monochromatic light by Young's experiment. 2. Fresnel's Biprism. 3. Determination of the diameter of a fine wire by interference. 4. Interference of light by Fresnel's mirror. 5. To verify Snell's law of refraction and measure the refractive index of glass by using laser light. 6. To measure the wave length of light using a diffraction grating and a spectrometer. 7. Velocity of light based on a pulsating LED. 8. Michelson interferometer. 9. Malus's Law of Polarization. 10. To measure refractive index of air by using Michelson Interferometer. 11. Single slit circular and apertures diffraction

19. Examinations:

1. <u>Multiple choices:</u>

Example:

Q. After passing through a diffraction grating with 600 lines/mm, at what angle does the second order diffracted beam of 500nm light emerge?

a) 72.5^0 b) 53.1^0 c) 90.0^0 d) 17.4^0 e) 36.9^0

2. Mathematica derivation

Q. If the focal length of a lens is *f* = 100mm. You place the object at a distance *S* = 50mm. Where will you find the image? Is it a real or virtual image?

3. Complete the following phrases:

Example:

***Q.* Explain one of the following:**

1. How does the spacing between fringes vary with the width of the slit?
2. Why it is easier to obtain fringes with a laser than with another light source?

4. Drive:

***Q.* Prove that the focal length of a thick lens is equal to:**

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

Suppose that f **is the focal length of a thin lens.**

20. Extra notes:

21. Peer review