# Physics Department

# College of Science

# Salahaddin University

# Subject: Optical Spectroscopy

# Course Book – (Year 3 – General Physics, Branch)

# Lecturer's name ***ABDULLAH O HAMZA***

# Academic Year: 2022-2023

# Course Book

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| **1. Course name** | **Optical Spectroscopy** |
| **2. Lecturer in charge** | **ABDULLAH OTHMAN HAMZA** |
| **3. Department/ College** | **PHYSICS/SCIENCE** |
| **4. Contact** | **e-mail: abdulla.hamza@su.edu.krd** |
| **5. Time (in hours) per week** | **Theory: 2**<br>**Practical: 0** |
| **6. Office hours** | **3** |
| **7. Course code** | **MP** |
| **8. Teacher's academic profile** | **I've been working for Salahaddin University since November 2003 when I got the position of an assistant physics in physics department. I've taught many physics courses for undergraduate students including: General Physics, Electricity and Magnetism, Mathematical Physics and recently Laser & optical communication systems. In parallel I've supervised laboratories and scientific projects of graduate Bachelor students.**<br>**B.Sc. Physics 2003/Salahaddin University Erbil**<br>**M.Sc. Solid state electronics 2007/ Salahaddin University Erbil**<br>**PhD Nanophotonics 2019/ University of Hull-UK** |
| **9. Keywords** | **Introduction-principles of optical spectroscopy, Light and E.M.waves, E.M. spectrum, E.M. energy, Emission and absorption of light, Line spectrum- Energy levels-Atomic spectra, Microwave spectroscopy, UV-Visible spectroscopy, Infrared spectroscopy, Raman spectroscopy, Electronic spectroscopy, Nuclear magnetic resonance (NMR) Spectroscopy** |

10. Course overview:

In this course, we provides a general understanding and principles of optical spectroscopy. After completing the course, the student is able to describe atomic and molecular absorption and emission spectra at different spectral ranges. The student is able to name the most common of spectroscopy, including Microwave spectroscopy, Infrared spectroscopy, Raman spectroscopy, Electronic spectroscopy. Nuclear magnetic resonance (NMR) spectroscopy Further, the student is able to compare different methods used in advanced optical spectroscopy and analyse their performance in sensing applications. Fortunately, students at such level have studied module includes the topic principles of modern physics, optics and light matter interaction as well as wave equations in the previous years of their university study. That will make our course more intensive course on optical spectroscopy.

**11. Course objective:**

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Nuclear magnetic resonance (NMR) spectroscopy Further, the student is able to compare different methods used in advanced optical spectroscopy and analyse their performance in sensing applications. Fortunately, students at such level have studied module includes the topic principles of modern physics, optics and light matter interaction as well as wave equations in the previous years of their university study. That will make our course more intensive course on optical spectroscopy.

**12. Student's obligation**

Students should have a Basic knowledge of optics, electromagnetism waves and quantum mechanics. A list of useful examples and problems will be given to help the students feel more comfortable with the subject and to improve their problem solving skills. The students are required to do these problems as well as to do at least two exams during two semesters besides other assignments.

**13. Forms of teaching**

The lectures are presented via data show on a screen while the solved problems and examples are done on a white board.

**14. Assessment scheme**

Students must do at least two exams; the marks are added and divided by two to give an average mark representing the overall contribution and skill of the students. This step has got 40% of the total mark and a final exam is going to hold the rest (60%)

**15. Student learning outcome:**

After completing the course, the student is able to Define spectroscopy, spectra, and spectrometer.

- Outline the development of spectroscopy as a science.
- Distinguish between emission and absorption spectra.

• Distinguish between line and band spectra.
Describe the infrared (IR), ultraviolet (UV), and visible regions of the electromagnetic spectrum.
• Describe how atoms and molecules absorb, store, and emit energy.
• Describe how electromagnetic energy is separated into different wavelengths by prisms and gratings.
• Describe how prisms, diffraction gratings, and interferometers are used in spectrometers to record emission and absorption spectra.

**16. Course Reading List and References:**

Material

- Type: Book
- Name: Modern Spectroscopy
- Author: J. Hollas
- ISBN: 0470844167
- Language: English

- Type: Book
- Name: Spectrophysics
- Author: Anne P. Thorne (auth.)
- ISBN: 978-0-412-27470-1
- Language: English

| **17. The Topics:**<br>**Note:**<br>This syllabus is subject to further change or revision, as needed, to achieve best realize the educational goals of the course. Students get advance notes either in class or on Moodle account to any modification. | **Lecturer's name** |
|---|---|
| Introduction-principles of optical spectroscopy, Light and E.M.waves, E.M. spectrum, E.M. energy, Emission and absorption of light, Line spectrum- Energy levels-Atomic spectra. | Abdullah O. Hamza |

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| Microwave spectroscopy. | Abdullah O. Hamza |
| UV-Visible spectroscopy | Abdullah O. Hamza |
| Infrared spectroscopy | Abdullah O. Hamza |
| Raman spectroscopy | Abdullah O. Hamza |
| Electronic spectroscopy | Abdullah O. Hamza |
| Nuclear magnetic resonance (NMR) Spectroscopy | Abdullah O. Hamza |
| **18. Practical Topics (If there is any)** | |
| In this section The lecturer shall write titles of all practical topics he/she is going to give during the term. This also includes a brief description of the objectives of each topic, date and time of the lecture | |
| **19. Examinations:** There will be at least two midterm examinations per 40%. The rest 60% will be on Final examination. | |
| **20. Extra notes:**<br>Here the lecturer shall write any note or comment that is not covered in this template and he/she wishes to enrich the course book with his/her valuable remarks. | |
| **21. Peer review پێداچوونەوەی هاوەڵ**<br>This course book has to be reviewed and signed by a peer. The peer approves the contents of your course book by writing few sentences in this section.<br>*(A peer is person who has enough knowledge about the subject you are teaching, he/she has to be a professor, assistant professor, a lecturer or an expert in the field of your subject).*<br>ئەم کۆرسبووکە دەبێت لەلایەن هاوەڵێکی ئەکادیمیەوە سەیر بکرێت و ناوەرۆکی بابەتەکانی کۆرسەکە پەسەند بکات و جەند ووشەیەک بنووسێت لەسەر شیاوی ناوەرۆکی کۆرسەکە و واژووی لەسەر بکات.<br>هاوەڵ ئەو کەسەیە کە زانیاری هەبێت لەسەر کۆرسەکە و دەبیت پلەی زانستی لە مامۆستا کەمتر نەبێت. | |

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| **Salahaddin University** | **Optical Spectroscopy** |
| **Science College** | **Time: 2 Hours** |
| **Physics Dept.** | **Final Examination** |
| **3rd year students** | |

**Q1/** Choose the correct answers for the following questions. 10 Marks

**Q2/** State whether the following sentences are true or false if false supply the correct word.

**Q3/** Define the following parameters?

**Q4/** What are the types of spectroscopy?

**Q6/** fill the following blanks

**Q5/** The adjacent lines in the pure rotational spectrum of 35Cl19F are separated by a frequency of 1.13x1010Hz. , what is the inter atomic distance of this molecule ?