Course Description of

**Physical Chemistry IV (Molecular Spectroscopy and Photochemistry)**

- The course deals with the interaction of electromagnetic radiation with matter, applications of molecular spectroscopy in the determination of structure and bonding of chemical compounds. A primer on photochemistry and photochemical reactions.

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### Basic Data

1. **Course Title**: Physical Chemistry IV
2. **Course Code No.**: Ch 431
3. **Credit Hours**: Five credit hours
   - Lectures: Lec 3 hrs
   - Rec 2 hrs
4. **Total hours**: 5 credit hours

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### Course Description

**The course is designed to help student-teachers achieve the following goals:**

- Explain the properties of electromagnetic radiation and its interaction with matter.
- Recognize the principles underlying rotational, vibrational, and Raman spectroscopy.
- Define the principles of NMR, ESR, and photoelectron spectroscopy.
- Explain principles of photochemistry and its applications.
2) Operational learning objectives of the course

By the end of this course, student teachers are expected to achieve the following objectives:

A) Knowledge and Comprehension:

- Recognize the interaction between electromagnetic and microwave with matter.
- Calculate the energy levels and transition probability.
- Apply spectroscopic measurements in elucidate molecular structure and bonding in chemical compounds.
- Explain photochemistry and its applications
- Recognize properties of electromagnetic radiation and its interaction with matter.
- Explain the principles underlying rotational, vibrational, and Raman spectroscopy.
- Calculate energy levels and transition probability.
- Comprehend the principle of NMR, ESR, and photoelectron spectroscopy.
- Grasp pertinent applications in determining the structure and bonding of molecular compounds
- Understand the phenomena of lasing and identifies different types of lasers.
- Show understanding of the concepts underlying photochemistry and its applications

B) Cognitive Skills:

- Apply mathematics, including calculus and statistics, to investigations in chemistry and the analysis of data.
- Relate the concepts of chemistry to contemporary, historical, technological, and societal issues; in particular, relate concepts of chemistry to current controversies, such as those around energy uses and medical research, as well as other issues.

C) Practical Skills:

- Locate resources, design and conduct inquiry-based open-ended investigations in chemistry, interpret findings, communicate results, and make judgments based on evidence
- Construct new knowledge for themselves through research, reading and discussion, and reflect in an informed way on the role of science in human affairs.
- Explain and promote the maintenance of a safe science classroom, including the appropriate use and storage of scientific equipment, and the safe storage, use, and disposal of chemicals.

D) Enabling Skills:

- Demonstrate competence in the practice of teaching as defined within the Entry-Level Standards.
- Create and maintain an educational environment in which conceptual understanding will occur for all science students.
- Demonstrate competence in the practice of teaching through investigative experiences and by demonstrating the application of the scientific process and assessing student learning through multiple processes.
- Develop an understanding and appreciation for the nature of scientific inquiry.
- **Explain** chemistry as the study of the composition, structure, properties, reactions of matter, and the dynamic interrelations of matter.

### Contents

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<th>Topic</th>
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<td><strong>Molecular Spectroscopy</strong></td>
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<td>vibration and rotation of molecules</td>
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<td>Fourth</td>
<td>Rotational, vibrational, and Raman spectra</td>
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<td>Fifth</td>
<td><strong>Electronic spectra</strong></td>
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<td>Sixth</td>
<td>nuclear magnetic resonance spectroscopy NMR</td>
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<td>Seventh</td>
<td>electron spin resonance spectroscopy ESR</td>
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<td>Eighth</td>
<td>optical rotatory dispersion (ORD)</td>
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<td>Ninth</td>
<td>circular dichroism (CRD), photoelectron spectroscopy</td>
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<td>Tenth</td>
<td>Lasers and kinds of lasers.</td>
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<td>Eleventh</td>
<td>Some pertinent applications of molecular spectroscopy in</td>
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<td>determining the structure and bonding of molecular</td>
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<td>Thirteenth</td>
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<td>quantum yield, photostationary states.</td>
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<tr>
<td>fifteen</td>
<td>First Assessment</td>
<td>3</td>
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</table>
**Activities, tasks and assignments:**

- Solve and discuss problem sets.
- Computational assignments and data analysis.
- Submission and class presentation of term papers.
- Computer aided and web based assignments and assessment.
- Visits to solar energy sites.

**Summative Evaluation table**

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<th>Score Weight</th>
<th>Evaluation Weight</th>
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<tr>
<td>1. Final exam</td>
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<td>1.期末考试</td>
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<tr>
<td>2. Practical exam</td>
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<td>2. 实践考试</td>
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<tr>
<td>3. Assessments</td>
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<td>3. 作业</td>
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<tr>
<td>Total</td>
<td>%100</td>
<td>总和</td>
</tr>
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</table>

**References:**


**كتب المحاضر:**

1- *Schaum's Outline of Physical Chemistry (2nd Ed...* by Clyde Metz

2- *Cracking the GRE Chemistry Test, 3rd Edition...* by Princeton Review

3- *GRE Chemistry (REA) - The Best Test P* by Staff of Research

4- *Instant Notes in Physical Chemistry* by Gavin Whittaker

- [WWW Virtual Library - Chemistry](#)
- [ChemDex-Sheffield List of Chemistry](#)
- [www.carolina.com/product/physical+science/chemistry/che.](#)
- [www.ecampus.com/book/067352342X.](#)
- [Chemical Information Sources from Indiana University](#)

- [Internet Resources: Chemistry](#)

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الأمكانيات المطلوبة للتعليم والتعلم
Educational sources:

- Textbooks
- Handouts and problem sets.
- Computational methods.

*Electronic, web, and multimedia based resources

Course coordinator: د. محمد عبد الله الطيف

Head of the Department: أ.د. مدحت شاكر

Date: 12/10/2009