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| | Ministry of Higher Education and Scientific Research - Iraq<br>Al-Nahrain University<br>College of Science<br>Physics Department | |

# MODULE DESCRIPTOR FORM
# نموذج وصف المادة الدراسية

| Module Information<br>معلومات المادة الدراسية | | | |
|---|---|---|---|
| **Module Title** | QUANTUM MECHANICS | **Module Delivery** | |
| **Module Type** | CORE | | ☒**Theory**<br>☒**Lecture**<br>☐**Lab**<br>☒**Tutorial**<br>☐**Practical**<br>☒**Seminar** |
| **Module Code** | | | |
| **ECTS Credits** | 4 | | |
| **SWL (hr/sem)** | 63 | | |
| **Module Level** | 2 | **Semester of Delivery** | 4 |
| **Administering Department** | Medical Physics | **College** | College of Science |
| **Module Leader** | Hassan N. Hashim | **e-mail** | hassan.hashim@nahrainuniv.edu.iq |
| **Module Leader's Acad. Title** | Assist. Professor | **Module Leader's Qualification** | Ph.D. |
| **Module Tutor** | Fatimah Fadhil Abd Ali | **e-mail** | fatimahfadhil33@nahrainuniv.edu.iq |
| **Peer Reviewer Name** | N.A | **e-mail** | |
| **Review Committee Approval** | | **Version Number** | |

| Relation With Other Modules<br>العلاقة مع المواد الدراسية الأخرى | | | |
|---|---|---|---|
| **Prerequisite module** | None | **Semester** | |
| **Co-requisites module** | None | **Semester** | |
| **Module Aims, Learning Outcomes and Indicative Contents**<br>أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية | | | |
| **Module Aims**<br>أهداف المادة الدراسية | 1. **To introduce the principles and formalism of quantum mechanics.**<br>2. **To develop problem-solving skills using quantum theory.**<br>3. **To explore the application of quantum mechanics in technology and modern physics.**<br>4. **To understand and discuss the philosophical implications of quantum mechanics.** | | |
| **Module Learning Outcomes**<br>مخرجات التعلم للمادة الدراسية | 1. **Demonstrate an understanding of quantum mechanical principles.**<br>2. **Solve quantum problems using the Schrödinger equation.**<br>3. **Analyze quantum systems such as particles in potential wells, oscillators, and atoms.**<br>4. **Discuss quantum entanglement, uncertainty, and measurement.**<br>5. **Apply quantum mechanics to real-world phenomena and technology (e.g., semiconductors, lasers, quantum computing).** | | |
| **Indicative Contents**<br>المحتويات الإرشادية | 1. Teaching the student the basic concepts of quantum mechanics.<br>2. Providing the student with the skills of discussing and solving applied problems related to quantum mechanics.<br>3. Linking theoretical concepts with practical applications. | | |
| **Learning and Teaching Strategies**<br>استراتيجيات التعلم والتعليم | | | |
| **Strategies** | 1. Discussing the topics of the methodological book and auxiliary references.<br>2. Theoretical lectures including problem solving and discussion of homework | | |

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| | 3. Asking students for a set of thinking questions during lectures on specific topics.<br>4. Giving students homework that requires finding solutions on their own. |

| Student Workload (SWL)<br>الحمل الدراسي للطالب | | | |
|---|---|---|---|
| **Structured SWL (h/sem)**<br>الحمل الدراسي المنتظم للطالب خلال الفصل | 63 | **Structured SWL (h/w)**<br>الحمل الدراسي المنتظم للطالب أسبوعيا | 4.2 |
| **Unstructured SWL (h/sem)**<br>الحمل الدراسي غير المنتظم للطالب خلال الفصل | 37 | **Unstructured SWL (h/w)**<br>الحمل الدراسي غير المنتظم للطالب أسبوعيا | 2.5 |
| **Total SWL (h/sem)**<br>الحمل الدراسي الكلي للطالب خلال الفصل | 100 | | |

## Module Evaluation
تقييم المادة الدراسية

| | | Time/ Number | Weight (Marks) | Week Due | Relevant Learning Outcome |
|---|---|---|---|---|---|
| **Formative assessment** | **Quizzes** | 2 | 10% (10) | 5, 10 | All |
| | **Assignments & H.W.** | 1 | 10% (10) | 2, 12 | All |
| | **Projects / Lab.** | 0 | 0% | | |
| | **Discussing During Lectures** | 1 | 10% (10) | 13 | All |
| | **Seminar** | 1 | 10% (10) | 12 | All |
| **Summative assessment** | **Midterm Exam** | 2 hr | 10% (10) | 9,13 | All |
| | **Final Exam** | 3hr | 50% (50) | 16 | All |
| **Total assessment** | | | 100% (100 Marks) | | |

## Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

| | **Material Covered** |
|---|---|
| **Week 1** | **Introduction to Quantum Mechanics** |
| **Week 2** | **Mathematical Tools for Quantum Mechanics** |

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| **Week 3** | **The Schrödinger Equation – Part 1** |
| **Week 4** | **The Schrödinger Equation – Part 2** |
| **Week 5** | **Quantum Superposition and Interference** |
| **Week 6** | **The Uncertainty Principle** |
| **Week 7** | **Quantum Mechanics in One Dimension** |
| **Week 8** | **Quantum Systems in Three Dimensions** |
| **Week 9** | **Quantum Mechanics of Angular Momentum** |
| **Week 10** | **Quantum Tunneling** |
| **Week 11** | **Quantum Entanglement and Nonlocality** |
| **Week 12** | **Quantum Mechanics and the Hydrogen Atom** |
| **Week 13** | **Midterm exam** |
| **Week 14** | **Quantum Statistical Mechanics** |
| **Week 15** | **Review and Final Exam Preparation** |
| **Week 16** | **Final Exam** |

| **Delivery Plan (Weekly Lab. Syllabus)**<br>المنهاج الاسبوعي للمختبر | |
|---|---|
| | **Material Covered** |
| **Week 1** | Lab 1: |
| **Week 2** | Lab 2: |
| **Week 3** | Lab 3: |
| **Week 4** | Lab 4: |
| **Week 5** | Lab 5: |
| **Week 6** | Lab 6: |
| **Week 7** | Lab 7: |

| **Learning and Teaching Resources**<br>مصادر التعلم والتدريس | | |
|---|---|---|
| | **Text** | **Available in the Library?** |
| **Required Texts** | ✓ Introduction to quantum mechanics, | https://kolegite.com/EE_library/books_and_lectures/Физика/int |

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| | By: David J. Griffith, 3rd ed.,2018. | roduction-to-quantum-mechanics-david-j-darrell--annas-archive--libgenrs-nf-2695391.pdf |
| **Recommended Texts** | **Quantum Mechanics, by L.I. Schiff, 1949.** | |
| **Websites** | Any website related with Quantum Mechanics Subjects. | |

**APPENDIX:**

| **GRADING SCHEME** مخطط الدرجات | | | | |
|---|---|---|---|---|
| **Group** | **Grade** | التقدير | **Marks (%)** | **Definition** |
| **Success Group (50 - 100)** | **A** - Excellent | امتياز | 90 - 100 | Outstanding Performance |
| | **B** - Very Good | جيد جدا | 80 - 89 | Above average with some errors |
| | **C** - Good | جيد | 70 - 79 | Sound work with notable errors |
| | **D** - Satisfactory | متوسط | 60 - 69 | Fair but with major shortcomings |
| | **E** - Sufficient | مقبول | 50 - 59 | Work meets minimum criteria |
| **Fail Group (0 – 49)** | **FX** – Fail | مقبول بقرار | (45-49) | More work required but credit awarded |
| | **F** – Fail | راسب | (0-44) | Considerable amount of work required |
| | | | | |

Note:

NB Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



ملاحظة: هذا النموذج تم وضعه وتقديمه من قبل مديرية ضمان الجودة في وزارة التعليم العالي والبحث العلمي