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جامعة : المنصورة

كــــلية : العلوم

قسم / الكيمياء

**توصيف مقرر دراسى**

| | ١- بيانات المقرر |
|---|---|
| المستوى : الثانى | أسم المقرر :Quantum chemistry | الرمز الكود :ك٤٤٢ |
| عدد الوحدات الدراسية: ٢     نظرى : ٢    تمارين: ١    عملى: - | البرنامج : الكيمياء |

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| **For students undertaking this course, the aims are to:**<br><br>1 - Introduce the basic concepts of quantum mechanics.<br><br>2 - Acquire the students skills to grasp challenging concepts of equations of motion of particles<br><br>3 - Outline the basic information of the world applications of the quantum mechanics.<br><br>4 - Enable the students to solve problems and obtain the energy levels and eigen functions of particles quantum mechanically by using Schrödinger equation | ٢- هدف المقرر : |

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٣- المستهدف من التدريس المقرر:

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| **a-  Knowledge and Understanding :**<br><br><br>a - 1 - Explain the basic concept and the origin of quantum mechanics<br><br>a - 2 - Acquire an understanding of more knowledge in physical quantities describing any particle.<br><br>a - 3 - Know the concepts of Schrödinger Eq. and its applicable problems<br><br>a - 4 - Recognize the different behavior quantum mechanical particles.<br><br>   **On completing this course, students will be able to:** | أ-المعلومات والمفاهيم: |
| **b- Intellectual Skills: On completing this course, students will be able to:** | ب-المهارات الذهنية |

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| b - 1 - Distinguish between the concept of quantum mechanics and classical mechanics<br><br>b - 2 - Apply mathematical formula of Schrödinger equation in solving challenging problems<br><br>b - 3 - Analyze and solve the different problems in quantum mechanics. | |
| **c-Professional and Practical Skills: On completing this course,**<br><br>c - 1 - Choose and classify data for obtaining the Schrödinger Eq.<br><br>c - 2 - Apply and solve the equation of motion of a mechanical system quantum mechanically.<br><br>c - 3 - Compare between quantum and classical principles to overcome the problems appear in classical mechanics.<br><br>**students will be able to:** | ج- المهارات المهنية<br><br>الخاصة بالمقرر: |
| **d-General and Transferable Skills: On completing this course,**<br><br>d - 1 - Solve problems describing different quantum mechanical systems via simulation method.<br><br>d - 2-Collect and analyze the data to find the solutions of the constructed equations of motion.<br><br>d - 3- Present short reports in oral and written means on some specified subjects.<br><br>⬜ d - 4- Work effectively both in a team, and independently to obtain the data required to overcome the quantum mechanical problems<br><br>**students will be able to:** | د- المهارات العامة : |
| Ch. 1: Introduction Postulates of Q. M., Schrödinger Eq. in space and momentum coordinates<br><br>Ch. 2: One-dimensional systems 2.1:-Bound states: infinite, finite, SHO, Morse and Delta function potentials. Linear infinite potential using momentum space. Operating method to solve SHO potential. 2.2:-Unbound states: Free particle, potential step, tunneling effect and radioactive alpha decay- periodic potential.<br><br>Ch. 3: Three-dimensional systems 3.1:-Rectangular Coordinates: three-dimensional box, three-dimensional harmonic oscillator and the degeneracy of their energy levels.3.2:- Cylindrical Coordinates: three-dimensional harmonic | ٤- محتوى المقرر: |

oscillator.3.3:- Spherical Coordinates: spherical-symmetric potential-isotropic harmonic oscillator-the space rotator-the Hydrogen-like atoms.

Ch. 4: Angular momentum operators Basic properties, Cartesian and spherical components, commutates relations, eigen values and eigen functions of the angular momentum operators, eigen values and eigen functions of the ladder operators.

Ch. 5: Approximation methods Time-independent perturbation theory for nondegenerate state (anharmonic oscillator and electric field perturbations).Time-independent perturbation theory for degenerate state (Stark effect in hydrogen atoms).

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| 4.1 - Lectures using data show and board.<br><br>4.2 - Discussion sessions<br><br>4.3 - Problem classes<br><br>4.4 - class activity | ٥ـ اساليب التعليم والتعلم: |
| **The same as normal students, only skeletal disabilities are allowed in the Faculty of Science.** | ٦ـ أساليب التعليم والتعلم للطلاب ذوى القدرات المحدودة: |
| | ٧ـ تقويم الطلاب : |

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أ- الأساليب المستخدمة :

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*7- Student Assessment Methods*

| Final exam | to assess | a1-a4, b1-b3 and c2, c3,d1 |
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| Oral exam | to assess | a1-a4, b1-b3 |
| Mid-term exam | To assess | a1-a4, b1-b3 and c2, c3,d1 |

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ب- التوقيت :

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Assessment Schedule

| Assessment 1 | Week #final exam | Week 16 |
|---|---|---|
| Assessment 2 | Week #oral exam | Week 16 |
| Assessment 3 | Week #mid-term | Week 7 |

| | exam | | |
|---|---|---|---|

| ج- توزيع الدرجات : | *Weighting of Assessments* | |
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| | **Final-Term Examination** | **80%** |
| | **Oral Examination** | **10%** |
| | **Practical Examination** | **0%** |
| | **Semester work** | **0%** |
| | **Mid-term examination** | **10%** |
| | **Other types of assessment** | **0%** |
| | **Total** | **100%** |

٨- قائمة الكتب الدراسية والمراجع :

| أ- مذكرات: | |
|---|---|
| ب- كتب ملزمة | 1 - Theoretical Phys., V3 Quantum Mech., B. G. Levich,1973<br><br>2 - Advanced Quantum Theory, S.L Fields, Gupta,1Ed, 1982<br><br>3 - Quantum Chemistry, R.K. Prased, New Delhi,2000 |
| ج- كتب مقترحة : | |
| د- دوريات علمية أو نشرات.. | http://www.whfreeman.com/pchem7/<br><br>http://www.mpcfaculty.net/ron_rinehart/physchem.htm |

## مصفوفة المعارف والمهارات المستهدفة من المقرر الدراسى

| المحتويات للمقرر | اسبوع الدراسة | المعارف الرئيسية | مهارات ذهنية | مهارات مهنية | مهارات عامة |
|---|---|---|---|---|---|
| Ch. 1: Introduction Postulates of Q. M., Schrödinger Eq. in space and | 1 | a1,a2,a3 | b1 | c1 | |

| momentum coordinates | | | | | |
|---|---|---|---|---|---|
| Ch. 2: One-dimensional systems 2.1:-Bound states: infinite, finite, SHO, Morse and Delta function potentials. Linear infinite potential using momentum space. Operating method to solve SHO potential. 2.2:- Unbound states: Free particle, potential step, tunneling effect and radioactive alpha decay- periodic potential. | 2-4 | a2,a3 | | | |
| Ch. 3: Three-dimensional systems 3.1:-Rectangular Coordinates: three-dimensional box, three-dimensional harmonic oscillator and the degeneracy of their energy levels.3.2:- Cylindrical Coordinates: three-dimensional harmonic oscillator.3.3:- Spherical Coordinates: spherical-symmetric potential- isotropic harmonic oscillator-the space rotator-the Hydrogen-like atoms. | 5-7 | a3,a4 | b2,b3 | | d1-d4 |
| Ch. 4: Angular momentum operators Basic properties, Cartesian and spherical components, commutate relations, eigen values and eigen functions of the angular momentum operators, eigen values and eigen functions of the ladder operators. | 8-10 | a3,a4 | | | |
| Ch. 5: Approximation methods Time-independent perturbation theory for nondegenerate state (anharmonic oscillator and electric field perturbations).Time-independent perturbation theory for degenerate state (Stark effect in hydrogen atoms). | 11-12 | a3,a4 | | c2,c3 | d1-d4 |

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