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| **Date**: 2018 – 12 – 28 | **Institution**: Umm Al-Qura University |
| **College**: Al-Jamoum University College | **Department**: Physics |

## A. Course Identification and General Information

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|---|---|---|---|
| 1. Course title and code: **Advanced theoretical methods in nanoscience (23066108-2).** | | | |
| 2. Credit hours: **2 credit hours.** | | | |
| 3. Program(s) in which the course is offered: **Nano physics Program, Al-Jamoum University College.** (If general elective available in many programs indicate this rather than list programs) | | | |
| 4. Name of faculty member responsible for the course: | | | |
| 5. Level/year at which this course is offered: **2nd Level.** | | | |
| 6. Pre-requisites for this course (if any): **Mathematical methods for nanoscience (23066107-2).** | | | |
| 7. Co-requisites for this course (if any): **-** | | | |
| 8. Location if not on main campus: **Al-Jamoum University College.** | | | |
| 9. Mode of Instruction (mark all that apply): | | | |
| a. Traditional classroom | ✓ | percentage? | 70% |
| b. Blended (traditional and online) | | percentage? | |
| c. E-learning | ✓ | percentage? | 30% |
| d. Correspondence | | percentage? | |
| e. Other: | | percentage? | |
| Comments: | | | |

## B. Objectives

1. The main objective of this course

**This course will introduce the student to theoretical methods such as Quantum physical methods and that are commonly used to study the electronic properties of important systems in Nanoscience.**

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

**In this context, the module focus on the connection of current research activities in nanoscience to their potential technological application.**

## C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

**Course Description:**

**The student will also learn the fundamentals of molecular structure, electronic and structural properties of surfaces and basic concepts on the chemical processes in gas/surface interactions. Furthermore, the student will get practice on the use of computer codes for Quantum physical calculations.**

**1. Topics to be Covered**

| List of Topics | No. of Weeks | Contact hours |
|---|---|---|

| | | |
|---|---|---|
| Introduction | 2 | 4 |
| Molecular Structure | 2 | 4 |
| Quantum physical Methods: Theory. | 3 | 6 |
| Quantum physical Methods: Exercises. | 2 | 4 |
| Properties of surfaces. | 2 | 4 |
| Adsorption processes. | 2 | 4 |
| Density Functional Theory. | 2 | 4 |

**2. Course components (total contact and credit hours per semester):**

| | | Lecture | Tutorial | Laboratory/ Studio | Practical | Other | Total |
|---|---|---|---|---|---|---|---|
| Contact Hours | Planned | 30 | | | | | 30 |
| | Actual | 30 | | | | | 30 |
| Credit | Planned | 1 | | | | | 2 |
| | Actual | 1 | | | | | 2 |

**3. Individual study/learning hours expected for students per week.**

**4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies**

**On the table below are the five NQF Learning Domains, numbered in the left column.**

**First**, insert the suitable and measurable course learning outcomes required in the appropriate learning domains (see suggestions below the table). **Second**, insert supporting teaching strategies that fit and align with the assessment methods and targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

**Curriculum Map**

| Code # | NQF Learning Domains And Course Learning Outcomes | Course Teaching Strategies | Course Assessment Methods |
|---|---|---|---|
| **1.0** | **Knowledge** | | |
| 1.3 | The process and mechanisms supporting the structure and function are specific topics. | | |
| 1.4 | Related terminology, numbering and classification systems. | | |
| 1.6 | Knowledge development related to the program. | | |
| **2.0** | **Cognitive Skills** | | |
| 2.2 | Analyzing, evaluating and interpreting relevant qualitative and quantitative scientific data. | | |
| 2.3 | Develop the argument and divorce the appropriate judgments according to scientific theories and concepts. | | |
| **3.0** | **Interpersonal Skills & Responsibility** | | |
| 3.2 | Application of techniques and tools related to scientific ethics. | | |
| **4.0** | **Communication, Information Technology, Numerical** | | |

| | | | |
|---|---|---|---|
| 4.1 | Use information and communication technology effectively | | |
| 4.3 | Think independently, assign tasks and solve problems on a scientific basis. | | |
| 4.5 | Taking into account societal problems associated with customs, traditions and ethics. | | |
| 4.6 | Ability to learn self and continuously. | | |
| 4.7 | Apply models, scientific systems and tools effectively. | | |

**5. Assessment Task Schedule for Students During the Semester**

| | Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.) | Week Due | Proportion of Total Assessment |
|---|---|---|---|
| 1 | 1st Quiz. | 7 | 10 |
| 2 | 2nd Quiz. | 11 | 10 |
| 3 | 1st Homework (E-Learning). | 4 | 10 |
| 4 | 2nd Homework (E-Learning). | 8 | 10 |
| 5 | Research. | 12 | 20 |
| 6 | Final written Examination. | 16 | 40 |

## D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week)

**Academic advising hours for guidance are included in the faculty member schedule of 4 hours per week.**

## E. Learning Resources

1. List Required Textbooks

**Handbook of Nanophysics: Principles and Methods (Volume 7) 1st Edition CRC Press; (2010)**

**Complex analysis: for mathematics and engineering, fifth edition, 2006 John H. Mathews and Russell W. Howell**

**Graduate mathematical physics. Kelly, james j. Wiley (2006).**

**Advanced engineering mathematics. Erwing kreyzig. John wiley&sons 10th edition (2015).**

**Mathematics methods for physics & engineering riley et al. Cambridge Group theory in physics**

2. List Essential References Materials (Journals, Reports, etc.)

3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

4. Other learning material such as computer-based programs/CD, professional standards or regulations and software.

## F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access, etc.)

1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)

Class room for 10 students.

2. Technology resources (AV, data show, Smart Board, software, etc.)

The class room should be equipped with a pc and data-show.

3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

## G. Course Evaluation and Improvement Procedures

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|---|
| 1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching<br>**Questioners.** |
| 2. Other Strategies for Evaluation of Teaching by the Instructor or the Department<br>**Using course report.** |
| 3. Procedures for Teaching Development<br>**Using course report.** |
| 4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution)<br>**A random sample of students' assessments is corrected through the committee formed by the department.** |
| 5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it.<br>**Review stakeholders and conduct periodic questioners.** |

**Name of Course Instructor: _____**

**Signature: _____ Date Completed: _____**

**Program Coordinator: _____**

**Signature: _____ Date Received: _____**