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

A. Course Identification and General Information

1. Course title and code: **Nanostructural properties (23066104-2).**			
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): **Nanoscience and nanotechnology (23066105-2)**			
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

The main goal of this module is to establish the connection between the nanostructures that have been presented in previous moduli and the different physical properties that those nanostructured materials hold.

Special emphasis will be addressed for a deeper understanding of the electronic structure in low dimensional systems, an introduction to transport properties, as well as an introductory review of magnetic, optical and mechanical properties of nanostructures.

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 modulus will be taught during the second semester of the first course of the master. In this way, the student will develop a solid basis on structural and electronic properties of different nanostructures during the first semester, and the connection with the different mechanical, optical, magnetic and transport properties can be reached progressively along the course.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Introduction. Thermodynamically approach to solid surfaces and nanostructured systems, Surface energy and stability, and Wulff construction.	1	2
Electronic properties. Jellium model, Periodicity: Bloch theorem and bands, Nearly-free electrons in solids and surfaces, Tight binding method, Truncated systems: electron localization effects,	3	6
Transport properties. Friedel model. Surface core level shifts, and Hubbard model. Mott transition. Origin of magnetic exchange.	3	6
Optical properties. Light propagation in a material, Localized and propagating plasmonic resonances in metallic nanostructures, Dielectric nanostructures, Microscopic description of the optical properties of materials, Microscopic polarizability, Forced damped harmonic oscillator model, and Drude Model.	2	4
Magnetic properties. Exchange and anisotropy, X-ray magnetic circular dichroism (XMCD), Layers, Magnetism in nanoparticles, and Giant magnetoresistance.	3	6
Mechanical properties. Linear Elastic Properties, Nonlinear Elasticity and Shell Model, Atomic Relaxation and Failure Mechanisms, Kinetic Theory of Strength , Coalescence of Nanotubes as a Reversed Failure.	3	6

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 nanoscience, Engineering, and technology", Donald Brenner, Sergey Lyshevski, Gerald Lafrate, William A. Goddard III (eds.) CRC PRESS, 3ed edition (2012).** **- "Encyclopedia of Nanoscience and Nanotechnology", Hari Singh Nalwa (ed.) American Scientific Publishers. 2005** **- "Exploring Nanotechnology" CD-ROM encyclopedia. NANOPOLYS. 2005** **- "Principles of Nano-optics", Lucas Novotny and Bert Hecht, Cambridge university Press, 2006** **"Mesoscopic Physics and electronics", T. Ando, Y. Arakawa, F. Furuya, S. Komiyama and H. Nakashima, Spinger, Kindle Edition (2012).** **- "Mesoscopic systems. Fundamentals and Applications", Yoshimasa Murayama, Wiley-Vch, 2001.**
2. List Essential References Materials (Journals, Reports, etc.)
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. http://nanotech.nanopolis.net
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

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching **Questioners.**
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department **Using course report.**
3. Procedures for Teaching Development **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) **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. **Review stakeholders and conduct periodic questioners.**

Name of Course Instructor: _____

Signature: _____ Date Completed: _____

Program Coordinator: _____

Signature: _____ Date Received: _____