COURSE SPECIFICATIONS
(CS)

Introduction to Nanoscience and Nanotechnology

PHYS 476

June 2018

Course Specifications

Institution	**King Saud University**	Date**2017**
College of Science/ Department of physics		

A. Course Identification and General Information

1. Course title and code:**Introduction to Nanoscience and Nanotechnology (PHYS 476)**			
2. Credit hours**2(2+0+0)**			
3. Program(s) in which the course is offered. (If general elective available in many programs indicate this rather than list programs) B Sc. Physics			
4. Name of faculty member responsible for the course: Dr. Bouraoui ILAHI			
5. Level/year at which this course is offered8^{th} level			
6. Pre-requisites for this course (if any)			
7. Co-requisites for this course (if any)PHYS 473			
8. Location if not on main campus			
9. Mode of Instruction (mark all that apply)			
a. traditional classroom	X	What percentage?	100
b. blended (traditional and online)		What percentage?	
c. e-learning		What percentage?	
d. correspondence		What percentage?	
f. other		What percentage?	
Comments: It's highly recommended to organize a guided visit of the student to the available Research Labs to familiarize them with dedicated equipments			

B Objectives

1. What is the main purpose for this course?
   - The student should be able to express on the basic physical knowledge on Nanotechnology. Including the effects of quantum confinement on the energy levels and density of states .
   - The student should appreciatethe available tools for fabrication and characterization of nanostructures.
   - .The student should be able to catch up with developments and applications in this rapidly evolving area.

2. Briefly describe any plans for developing and improving the course that are being implemented. (e.g. increased use of IT or web based reference material, changes in content as a result of new research in the field)
   - Introduce the strategy of the course at the beginning of the semester
   - Highlighting the latest developments in the field and their impact on the human life (medical, communication, renewable energy ..).
   - Considering individual and collective mini bibliographic research projects dealing with up-to-date topics
   - Encourage the students to look up active web sites and references.
   - Use of interactive and animated audiovisual tools to simplify the complicated concepts
   - Full accessibility to course materials over the net to encourage student interactivity.

C. Course Description (Note: General description in the form used in Bulletin or handbook)

Course Description:
Introduction to nanophysics and nanotechnology – scaling laws and limits to smallness; quantum nature of nanoworld; nano fabrication (top-down and bottom-up process); nanoscopy (electron microscopy, atomic force microscopy, scanning tunneling microscopy).
Properties and application of dielectric and metal nanostructures - individual nanoparticles and nanoclusters; nanostructured materials; carbon nanostructures; nano spin and nanomagnets.
Properties and application of semiconductor nanostructures - fabrication of semiconductor nanowires and quantum dots; electronic and optical properties (2D and 3D quantum confinement); optical spectroscopy of semiconductor nanostructures (local probe techniques); quantum dots nanowire- and quantum-dot-based electronic and photonic devices.

1. Topics to be Covered		
List of Topics	No. of Weeks	Contact hours
A. Introduction to nanophysics and nanotechnology – scaling laws and limits to smallness; quantum nature of nano-world; nano fabrication (top-down and bottom-up process);	3	6
Nano-scopy (electron microscopy, atomic force microscopy, scanning tunnelling microscopy).	2	4
B: Properties and application of dielectric and metal nanostructures - individual nanoparticles and nanoclusters;	2	4
Nnano-structured materials; carbon nanostructures; nano spin and nano-magnets.	2	4
C. Properties and application of semiconductor nanostructures - fabrication of semiconductor nanowires and quantum dots;	2	4
Electronic and optical properties (2D and 3D quantum confinement); optical spectroscopy of semiconductor nanostructures.	2	4
Quantum dots nanowires- and quantum-dot-based electronic and photonic devices.	2	4

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

	Lecture	Tutorial	Laboratory or Studio	Practical	Other:	Total
Contact Hours	30					30
Credit	2					2

3. Additional private study/learning hours expected for students per week. 3

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

- Knowledge and skills of the nanoscience is to be developed;

- A description of the teaching strategies to be used in the course to develop that knowledge or skill;

Methods of student assessment to be used in the course to evaluate learning outcomes in this field.

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 intended learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy ought to reasonably fit and flow together as an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Students are able to understand the fundamentals ofNano Science and technology and characterization of nano materials.	Lectures Text Books Smart Board	Quizzes Short exams Long exams (final) MCQs
1.2	Students are able to apply the nano technology and characterization of nano materials to synthesis new materials	Lectures Text Books Smart Board	•In class short MCQs quizzes. •Major and final examinations Home work
2.0	**Cognitive Skills**		
2.1	Students are able to use physical laws and principles to solve related problems	1. Discussion 2. Problem solving during Lecture	. Quizzes exams Discussion
2.2	Students are able to organize and evaluate breakdown problems and analyze phenomena	Lecture/Discussion	Discussion
2.3	Students are able to understand general research papers, lectures and scientific programs found on the internet	Lecture/Discussion	Discussion
3.0	**Interpersonal Skills & Responsibility**		

3.1	Self -learning	Inverted class.	Presentation and discussion
3.2	Work in groups	Solving problems in groups during tutorial at the end of each chapter enhance educational skills.	discussion
4.0	**Communication, Information Technology, Numerical**		
4.1	students are able to use the internet for communication and homework /solving problems	Submission of home work and communicating by email	Discussion
4.2	Students are able to present written reports that make adequate use of various computer packages. The efficient use of networks in search for information.	Report writing and presentation.	Discussion
5.0	**Psychomotor**		
	N/A		

5. Map course LOs with the program LOs. (Place course LO #s in the left column and program LO #s across the top.)

Course LOs #	**Program Learning Outcomes (Use Program LO Code #s provided in the Program Specifications)**								
	1.1	**1.2**		**2.1**		**3.2**		**4.1**	
1.1									
2.1									

6. Schedule of Assessment Tasks for Students During the Semester

	Assessment task (e.g. essay, test, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Midterm 1	6th week	20
2	Midterm 2	12th week	20

3	project	7th,12th week	10
4	HW& Attendance	Every week	10
5	Final exam	End of semester	40
6			
7			
8			

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice. (include amount of time teaching staff are expected to be available each week) 6 hours

E Learning Resources

1. List Required Textbooks

Nanophysics and Nanotechnology: An Introduction to Modern Concepts in Nanoscience, 3rd Edition	Edward L. Wolf ,	Wiley-VCH	2015
Introduction to Nanoscience	S.M. LINDSAY	Oxford University Press Inc., New York	2010
مقدمة يف تقنية النانو "Introduction to Nanotechnology"	Charles P. Poole Jr and Frank J. Owens ترجمة: أ.د. عبد الله الضويان و أ.د. محمد الصالحي	John Wiley & Sons, دار النشر لجامعة الملك سعود	2003 2017

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

3. List Recommended Textbooks and Reference Material (Journals, Reports, etc) . Nano- and Micro-Electromechanical Systems: Fundamentals of Nano- and Microengineering, Second Edition, Sergey Edward Lyshevski
4. List Electronic Materials, Web Sites, Facebook, Twitter, etc. *www.nanoscience.com/applications/education/resources/* www.**nanoscience**.cam.ac.uk/
5. Other learning material such as computer-based programs/CD, professional standards or regulations and software. COMSOL multiphysics

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.) Classroom 30 students Access to research lab having nanosciences activities
2. Computing resources (AV, data show, Smart Board, software, etc.) Computer room Scientific Mathematical packages
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching

Office hours and e-mail correspondence.

Seminars.

2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department

3 Processes for Improvement of Teaching

Update the teaching strategy with instructional methods shown to work in literature,

4. Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution)

- Various instructors comparison of notes.
- Exam evaluation by colleagues..
- Feedback evaluation by independent organization.

5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.

1- The following points may help to get the course effectiveness
   - Student evaluation
   - Course report
   - Program report
   - Program self study
2- Accordingly a plan of improvement should be given.
3- Contact other colleges and ask colleagues to evaluate the course and the input of it into other courses.

Keep abreast with the fast tempo of the nano-world.

Name of Instructor: _____

Signature:_____Date Report Completed:_____

Name of Field Experience Teaching Staff _____

Program Coordinator:_____

Signature: _____ Date Received:_____