Course Specifications

Course Title:	Introduction to Nanotechnology
Course Code:	PHY4706
Program:	Physics
Department:	Physics
College:	Applied Science
Institution:	Umm Al-Qura University

Table of Contents

A. Course Identification

1. Credit hours:	3h

2. Course type

a. University ☐   College ☐   Department ☑   Others ☐

b. Required ☐   Elective ☑

3. Level/year at which this course is offered:	4th year

4. Pre-requisites for this course (if any): **Solid State Physics 1**

5. Co-requisites for this course (if any):

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	30
2	Laboratory/Studio	
3	Tutorial	
4	Others (specify)	
	Total	30

B. Course Objectives and Learning Outcomes

1. Course Description

The course indicates nanofabrication technology (how one achieves the nanometre length scale, from "bottom up" to "top down" technologies), the interdisciplinary nature of nanotechnology and nanoscience, examples of nanoscience phenomena (the crossover from bulk to quantum mechanical properties), and applications (from integrated circuits, quantum computing, MEMS, and Nano-magnetics).

2. Course Main Objective

-The aim is to provide students with knowledge and understanding fundamentals of Nanotechnology.

-To explain methods of fabricating nanostructures.

-To provide a base to students for his future research and study planning.

-To describe tools for properties of nanostructures

-To develop an interest in student to study more for this emerging nanotechnologies.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Describe physics laws active in the nano-range and as they differ from those in the micro-range.	K1
1.2	Explain how to characterize major top-down and bottom-up strategies.	K2
1.3	Outline the basics of the electronic structure of atoms, molecules, and nano-particles.	K1
1.4		K1
1.5		K2
	List five techniques used to characterize nanomaterials	K2
2	**Skills :**	
2.1	Distinguish between zero, one and two nanostructuresﻭ	S1
2.2	Discuss how to tune properties of carbon-based nanostructures	S2
2.3		S3
2...		

C. Course Content

No	List of Topics	Contact Hours
1	General introduction and history of nanotechnology. Importance of nanoparticles in industries and in our lives.	3
2	Approaches in nanotechnology and typical syntheses of nanoparticles.	3
3	Properties of nanomaterials, chemical and physical properties. Reasons for changing the properties, Effects of the nanometre length scale.	6
4	Formation of energy gap, Discreteness of energy levels	3
5	Fabrication methods - Top-down and Bottom-up processes, Tunneling currents.	6
6	Nanodevices and applications.	3
7	Formation and characterization of Nanolayers, Applications of Nanolayers.	3
8	Synthesis and Fabrication of Nanoparticles, Characterization and Application of Nanoparticles.	6
9	The impact of nanotechnology: Scientific, Technical and Environmental	6
Total		39

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	Recognize the changes in surface properties as decrease size of structures	Lecture	Written exam
1.2	Explain the top-down and bottom-up processes used to fabricate nanomaterials	Problem solving	Written exam

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.3	Outline the impact of nanotechnology on technology, health, energy and environment.	Lecture	Report assignments
1.4	List five techniques used to characterize nanomaterials	Problem solving	Homework assignments
2.0	**Skills**		
2.1	Distinguish between zero, one and two nanostructures	Lecture	Written exam
2.2	Discuss how effects of the nanometre length scale	Lecture	Report assignments
2.3	Compare between different fabrication methods nano films.	Lecture	Written exam

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Assignments, participations, and quizzes	Throughout Semester	10 %
2	Midterm Exam	Week 6	30 %
3	Oral presentation	Week 8	10 %
4	Final Exam	Week 13	50 %

*Assessment task (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :
Different arrangements made by teaching staff to support student consultations:
- • Office hours: 8h per a week for each academic member.
- • Academic guidance: an academic member has a number of students to guide them throughout degree journey.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Nanotechnology and Nanoelectronics Materials, Devices, Measurement Techniques, R. Fahrner, Springer, 2010
Essential References Materials	Nanostructures And Nanomaterials: Synthesis, Properties, and Applications. Guozhong Ca, 2004. Nanotechnology: An Introduction, Second Edition. Jeremy J. Ramsden, 2016.

Electronic Materials	Blackboard
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	A classroom with movable tables and chairs conducive to group discussion and teamwork.
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show, smart board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Peer Reviewer	Direct
Effectiveness of assessment	Students	Indirect
Extent of achievement of course learning outcomes	Peer Reviewer	Direct
Quality of learning resources	Program Leaders & Faculty	Direct

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	