COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
Nanotechnology and Materials	PHYS 651	3	4 + 0	4	10

Prerequisites	

Language of Instruction	English
Course Level	Postgraduate
Course Type	Elective
Course Coordinator	
Instructors	
Assistant	
Goals	To provide knowledge of nanophysics and nanotechnology to students wishing to pursue research in this field that was propelled to international importance in the mid-2000's. To advance a nanotechnology research and development (R&D) program and the supporting infrastructure and tools to advance nanotechnology in the department, to develop and sustain educational resources and to support responsible development of nanotechnology.
Content	Introductory concepts, nanotechnology and biology, solid state physics and nanotechnology, chemistry and nanoscience, quantum confinement in semiconductors, metallic nanoparticles, dielectric confinement, spectroscopy and tools for nanotechnology.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) To acquire knowledge of nanotechnology and how it impacts the modern world	1 ,12	A,C
2) To develop an understanding of the potential of nanoscience to develop present day technology	1 ,12	A
3) To appreciate the foundations of nanotechnology in molecular machines and biology.	1,12	A
4) To appreciate the far superior energy efficiencies of biological machines compared to thermodynamic principles of macro machines	1,12	A
4) To be capable of categorising three, two, one and zero dimensional confined systems.	1	A
5)To gain knowledge in the processes of self-assembly, their present uses and future potentials	1	

6) To be capable of calculating changes in physical, chemical, electrical and optical properties as particle sizes scale (mesoscopic to nanoscopic dimensions)	1,2	A
7) To understand the importance of quantum mechanical spin and the exchange interaction to the nanophysical bond and that the Casimir force is a nanophysical force of great technological and scientific importance	1	A
8) To understand and differentiate between the concepts of confinement in both metals and semiconductors and the entities called excitons.	1	A
9) To be able to calculate parameters related to quantum confined semiconductors such as exciton energies, Bohr radii, tightness of confinement and relate them to nanophysics spectra	1	A,C
10) To be able to predict how the density of states changes as the dimensionality of confinement changes.	1	A

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Discussion, 9: Simulation, 12: Case Study
Assessment Methods:	A: Testing, C: Homework

COURSE CONTENT

Week	Topics	Study Materials
1	Nanotechnology and its impact on the modern world	
2	The development of nanotechnology from biology	
3	Introduction to nanoscience and finite size effects, scaling	
4	Molecular self assembly	
5	Biological examples of nanodevices	
6	Student Seminars and presentations	
7	Review of solid state physics and potential wells	
8	Nanophysical bonds	
9	The Casimir force	
10	Review of semiconductors, quantum dots,	
11	Quantum confinement, dielectric confinement and the effective mass model	
12	Modification of the density of states with dimensional confinement,	

13	Nanoparticle synthesis and superlattices	
14	Scanning probe microscopies, tools for nanotechnology	

RECOMMENDED SOURCES	
Textbook	Nanophysics and nanotechnology- E. Wolf
Additional Resources	Introduction to nanoscience by Rice University- Nanonet, Introduction to solid state physics, 8th edn - C. Kittel, Principles of nano-optics – Novotny & Hecht, Contemporary Nonlinear Optics Govind Agrawal (Editor), Robert W. Boyd.

MATERIAL SHARING	
Documents	Contemporary Nonlinear Optics Govind Agrawal (Editor), Robert W. Boyd
Assignments	Four homework assignments
Exams	Two mid-term exams and one final

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	40
Lab practicals	0	0
Assignment	4	10
Total		**50**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		50
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		50
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	Gets a sound base for the main fields of physics such as Classical Mechanics, Quantum Mechanics and Electromagnetism,					X	

2	Gets the ability of interpreting, analysing, forming a synthesis and relationships between the main fields of physics and/or other sciences,					X
3	Obtains the education required for the measurements in scientific and technological areas and the contribution of physics in the industrial applications and on the macroscopic scale such as the society,				X	
4	Follows the up-to-date scientific developments, makes the analysis/synthesis for the new ideas and evaluates them,				X	
5	Uses the academic sources, the computer technology and the related devices,		X			
6	Joins the working and research groups, also the scientific meetings, communicates well at the national and international level,		X			
7	Gets the ability of creative and critical thinking, problem solving, researching, producing a new and original work, improving himself/herself in his/her own fields of interest,					X
8	Gains the concepts of ethics and responsibility. Undertakes the responsibility for the solutions to the problems related with his/her field as required for having an intellectual identity.		X			

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Including the exam week: 16x Total course hours)	16	4	64
Hours for off-the-classroom study (Pre-study, practice)	16	9	144
Mid-terms	2	2	4
Homework assignments	4	6	24
Final examination	1	2	2
Total Work Load			238
Total Work Load / 25 (h)			9.52
ECTS Credit of the Course			10