



Jordan University of Science and Technology
Faculty of Science & Arts
Physics Department

PHY375 Introduction To Nano Science And Technology

First Semester 2022-2023

Course Catalog

3 Credit Hours. The scope of the Introduction to nano-science and Technology (1) course addresses the scientific aspects of nano and explores the practical applications of nano. This course is divided into six general divisions: (1) The Nano World (2) Synthesis of Nanomaterials (3) Characterization Methods for Studying Nanomaterials (4) Unique Properties of Nanomaterials (5) Nanomaterials and Nanotechnology Applications (6) Toxicity and Environmental Issues. Division 1 ?The Nano World,? reviews definitions and discusses the revolutionary impact of nanotechnology on human civilization. Also, it shows some examples of nanomaterials and nanostructures in nature. Division 2 is titled ?Synthesis of Nanomaterials,? describes general synthetic approaches and strategies while division 3 ?Characterization Methods for Studying Nanomaterials,? deals with the characterization of nanomaterials using modern tools and techniques to provide a basic understanding to students who are interested in exploring this promising area. Division 4 ?Unique Properties of Nanomaterials,? is devoted to explaining that nanoscience is not merely about size. In fact, it is about the unique physical, chemical, biological, and optical properties that emerge naturally at the nanoscale. Next, division 5 ? Nanomaterials and Nanotechnology Applications,? talks about applications of nanotechnology in various disciplines such as information technology, pollution, environment, energy, healthcare, consumer goods, and so on. Finally, the last division 6 ?Toxicity and Environmental Issues,? deals with the toxicological issues associated with nanotechnology.

Text Book

Title	Introduction to Nano: Basics to Nanoscience and Nanotechnology by
Author(s)	Amretashis Sengupta & Chandan Kumar Sarkar.
Edition	25th Edition
Short Name	Ref #1
Other Information	

Course References

Short name	Book name	Author(s)	Edition	Other Information
Ref #2	2. Nanomaterials: An Introduction to Synthesis, Properties and Applications	Dieter Vollath.	2nd Edition	
Ref # 3	Understanding Nanomaterials	Malkiat S. Johal & Lewis E. Johnson	2nd Edition	

Instructor	
Name	Khaled Al-Shurman
Office Location	-
Office Hours	
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Class Schedule & Room
Section 1: Lecture Time: Sun, Tue : 09:30 - 10:30 Room: NG41

Prerequisites		
Line Number	Course Name	Prerequisite Type
922310	PHY231 Electronics (1)	Prerequisite / Pass

Tentative List of Topics Covered		
Weeks	Topic	References
Week 1	The Nano World: 1.1 Introduction 1.2 Nanotechnology 1.3 Nanoscience 1.4 Examples of Nanomaterials and Nanostructures Found in Nature	
Weeks 2, 3, 4	1 Synthesis of Nanomaterials 1.1 Introduction 1.2 Nanometer-Scale Materials 1.3 Types of Nanometer-Scale Materials 1.4 General Synthetic Approaches of Nanometer-Scale Materials 1.4.1 Top-Down Techniques 1.4.2 Bottom-Up Techniques 1.5 Synthesis of Nanomaterials?I (Physical Methods) 1.5.1 Mechanical Methods 1.5.2 Methods Based on Evaporation 1.5.3 Sputter Deposition 1.5.4 Chemical Vapour Deposition (CVD) 1.5.5 Electric Arc Deposition 1.5.6 Ion Beam Techniques (Ion Implantation) 1.5.7 Molecular Beam Epitaxy (MBE) 1.6 Synthesis of Nanomaterials?II (Chemical Methods) 1.6.1 Colloids and Colloids in Solutions 1.6.2 Nucleation and Growth of Nanoparticles 1.6.3 Synthesis of Metal Nanoparticles by Colloidal Route 1.6.4 Synthesis of Semiconductor Nanoparticles by Colloidal Route 1.6.5 Langmuir-Blodgett (LB) Method 1.6.6 Microemulsions 1.6.7 Sol-Gel Method 1.6.8 Hydrothermal Synthesis 1.6.9 Sonochemical Synthesis 1.6.10 Microwave Synthesis 1.6.11 Synthesis Using Micro-reactor or Lab-On-Chip 1.7 Synthesis of Nanomaterial	
Weeks 5, 6, 7, 8	3 Characterization Methods for Studying Nanomaterials 3.1 Introduction 3.2 Scanning Electron Microscopy 3.3 Transmission Electron Microscopy 3.4 Scanning Tunneling Microscopy 3.5 Atomic Force Microscopy 3.6 X-ray Diffraction 3.7 UV-VIS Spectroscopy 3.8 Raman Spectroscopy	
Weeks 9, 10, 11	4 Unique Properties of Nanomaterials 4.1 Introduction 4.2 Size Effects 4.3 Physical Properties 4.4 Chemical Properties at Nanoscale 4.5 The Concept of Pseudo-Atoms	
Weeks 12, 13, 14	5 Nanomaterials and Nanotechnology Applications 5.1 Introduction 5.2 Medicine and Healthcare 5.3 Drug Development and Drug Delivery System 5.4 Information and Computer Technologies 5.5 Nanoelectromechanical Systems (NEMS) 5.6 Nanotechnology for Environmental Issues 5.7 Energy	

Weeks 15, 16	6 Toxicity and Environmental Issues 6.1 Introduction 6.2 Sources of Nanoparticles and Their Health Effects 6.3 Toxicology of Engineered Nanoparticles 6.4 Safe Working with Nanomaterials 6.5 Nanomaterial Waste Management	
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Mapping of Course Outcomes to Program Student Outcomes	Course Outcome Weight (Out of 100%)	Assessment method
Mid+Final [351, 354, 155, 156]	100%	

Relationship to Program Student Outcomes (Out of 100%)					
1	2	3	4	5	6
35			35	15	15

Evaluation	
Assessment Tool	Weight
Final	50%
Midterm	50%

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