INSTRUCTION DIVISION
SECOND SEMESTER 2014-15
Course Handout (Part II)

Date: 07/01/2016

In addition to Part I (General Handout for all courses appended to the Time Table), this portion gives further specific details regarding the course.

Course No:	**BITS F429**
Course Title:	**Nanoctechnology for Renewable Energy and Environment**
Instructor-in-Charge:	**Banasri Roy**
Other Instructor:	**Smita Raghuvanshi**
Lectures:	**M W F, 8th HR (3 pm), room 6106**

Objectives:

This course is on conceptual, theoretical, and practical application aspects of nanotechnology. The particular characteristics and relative theories regarding the nanomaterials, which make them highly competitive and potential candidates for renewable energy as well as environmental applications, will be covered extensively. Consequence of nanotechnology relevant to our environment will be addressed. Theory of the advanced tailoring techniques in nanomaterial's preparation and corresponding characterizations shall be dealt with in this course.

Course Description: In this course we will mainly discuss:

- Applications and theory of nanomaterials and nanotechnology in renewable energy
- Applications and theory of nanomaterials and nanotechnology in environmental fields.
- Impact of nanotechnology on the earth's environment & how it can act as a tool for sustainable development
- Processing and characteristics of the nanos corresponding to those applications.

Textbook (s):

TB-1: Mitin, Sementsov, and Vagidov, " Quantum Mechanics for Nanostructures", CAMBRIDGE UNIVERSITY PRESS, ed 1 (March 22, 2010) ISBN-13: 978-0-511-72953-9.
TB-2: Javier García-Martínez, "Nanotechnology for the Energy Challenge," Wiley-VCH; ed 1 (March 22, 2010) ISBN-10: 3527324011.
TB-3: Mark R Weisner & Jean-Yves Bottero, "Environmental nanotechnology; applications and impacts of nanomaterials", McGraw Hill, 2007.

Reference Books:

1. Bharat Bhushan, “Handbook of Nanotechnology”, Springer, Germany, 2nd ed., 2006, ISBN 13: 9783540298557
2. Hari Singh Nalwa, “Handbook of Nanostructured materials and Nanotechnology”, Academic press, 2001, ISBN 13: 9780080533643.

3. Paul Harrison, “Quantum wells, Wires & Dots,: Theoretical & Computational Physics of Semiconductors Nanostuructures”, John Wiley & Sons, Ltd, 2nd ed., 2006, ISBN 13: 9780470010792.
4. Louis Theodore and Robert G. Kunz, "Nanotechnology; environmental implications and solutions", John Wiley, New York, 2005.
5. Charles P Poole & Frank J. Ownes, "Introduction to Nanotechnology", Wiley-Interscience; 1st ed., ISBN-13: 978-0471079354
6. T. Pradeep, "A text book of Nanoscience & Nanotechnology," McGraw Hill India, 1st ed., 2015, ISBN 13: 9781259007323.
7. Nanotechnology Applications for Clean Water, Edited by, N. Savage, M. Diallo, J. Duncan, A. Street, R. Sustich

Basic Course Content:

Lec. Num.	Learning Objectives	Topics to be covered	Chapter in book
1	Introduction	Course Introduction, What is nanoscience and nanotechnology?	TB-1 + Notes in class
2-5	Theory of Nano science and nanotechnology	Basics of Nano Physics, Macro vs. nano, Building Block for Nano devices, Quantum Dots, Quantum wells, Super Conductivity at Nano Scale, Single Electron Tunneling, wires and Dots – Size and dimensionality effects,	TB-1 + Notes in class
6-9	Nanotechnology in Energy Applications: Part A	Solar cell: Organic solar cell, quantum dot solar cell, dye sensitized solar cell. Self cleaning in solar panel. Preparation, mechanism, and characterization	TB-2 + Notes in class
10-12	Nanotechnology in Energy Applications: Part B	Fuel cell: Nano electrode and catalysts, Systems, preparation, mechanism, characterization, and applications	TB-2 + Notes in class
13-15	Nanotechnology in Energy Applications: Part C	Batteries: Nano electrode based batteries. Systems, preparation, mechanism, characterization, and applications	TB-2 + Notes in class
16-19	Nanotechnology in Energy Applications: Part D	Catalysts; H_2 production and H_2 storage; Carbon nanotube for energy. Systems, preparation, mechanism, characterization, and applications	TB-2 + Notes in class
20 - 21	Nanotechnology in environmental field	Nanotechnology as tool for Sustainability, Environmental implications	TB-2 & R4
22 - 24	Nanotechnology in environmental	Environmental fate & transport of nanomaterials	Discuss in class from research

	field: Part A		papers
25 - 30	Nanotechnology in environmental field: Part B	Nanomaterials for ground water remediation: Introduction, reactivity, fate & lifetime, Delivery & transport issues	TB-2
31 - 33	Nanotechnology in environmental field: Part C	Nanomaterials as adsorbents: Adsorption at oxide nanoparticles, Solution interface, Nano materials adsorbent for water and waste water treatment	TB-2
34 – 36	Potential impacts of nanomaterials	Toxicity of nanomaterials, Ecotoxicological impacts of nanomaterials, Paradigms in nanomaterial toxicity	TB-2 & Research Papers
37 – 38	Societal implications of nanotechnology	Provide awareness about the social economic impact of nanotechnology and to handle the techniques effectively, enhance the nanotechnology research by taking ethics and public opinion into consideration	Class notes & Based on Research Papers

6. Evaluation Scheme:

No.	Component	Duration	Weightage (300 marks/100%)	Remarks	Date & Time
1.	Mid-Term Test	1½ hrs	75 (25 %)	CB and/or OB	17/3 9:00 - 10:30 AM
2.	Project	--	60 (20 %)	--	
3.	Assignments/ Quiz	--	30 (10 %)	CB and/or OB	
4.	Comprehensive	3 hrs	105 (35 %)	CB and/or OB	10/5 FN
5	Class Participation/class tests	---	30 (10 %)	----	

CB - Close book OB - Open book TB - Text book R - Reference book

- Chamber consultation hour will be announced in the class.
- The notices will be displayed on the Chemical Engineering Group notice board and/or Nalanda only.
- Make-up will be granted for genuine cases only. Certificate from authenticated doctor from the Medical Center must accompany make-up application (*only prescription or vouchers for medicines will not be sufficient*). Prior permission of IC is compulsory.
- No make up for Assignments/ Quiz, projects, and Class Participation/class tests.

Instructor-in-charge
(BITS F429)