Cover Sheet: Request 11727

SWS 4XXX - Nanotechnology in Food, Agriculture, and Environment

Info

Process	Course|New|Ugrad/Pro
Status	Pending at PV - University Curriculum Committee (UCC)
Submitter	Michael Sisk mjsisk@ufl.edu
Created	6/28/2017 11:01:05 AM
Updated	10/9/2017 4:05:37 PM
Description of request	New Undergraduate Course in Soil and Water Sciences Department.

Actions

Step	Status	Group	User	Comment	Updated
Department	Approved	CALS - Soil and Water Science 514921000	Michael Sisk		6/28/2017
Joint_Letter_Undergraduate_&_Graduate Coordinator.pdf					6/28/2017
College	Approved	CALS - College of Agricultural and Life Sciences	Michael Sisk	Corrections requested by the CALS CC have been addressed.	9/1/2017
No document changes					
University Curriculum Committee	Commented	PV - University Curriculum Committee (UCC)	Michael Sisk	Added to October agenda.	9/14/2017
No document changes					
University Curriculum Committee	Pending	PV - University Curriculum Committee (UCC)			9/14/2017
No document changes					
Statewide Course Numbering System					
No document changes					
Office of the Registrar					
No document changes					
Student Academic Support System					
No document changes					
Catalog					
No document changes					
College Notified					
No document changes					

Course|New for request 11727

Info

Request: SWS 4XXX - Nanotechnology in Food, Agriculture, and Environment
Description of request: New Undergraduate Course in Soil and Water Sciences Department.

Submitter: Michael Sisk mjsisk@ufl.edu
Created: 10/9/2017 9:46:16 AM
Form version: 3

Responses

Recommended PrefixSWS
Course Level 4
Number XXX
Category of Instruction Joint (Ugrad/Grad)
Lab Code None
Course Title Nanotechnology in Food, Agriculture, and Environment
Transcript Title Nanotechnology Appl.
Degree Type Baccalaureate

Delivery Method(s)4138Online
Co-Listing Yes
Co-Listing Explanation Graduate Students Will Be Required To Conduct an Independent Nanotechnology Project. For this project, students will select one of the nanotechnology application areas (food processing/preservation, agricultural production/nanofertilizers, soil and water quality, and environment-pollution control/toxicology, etc.), conduct a literature review based on journal articles, book chapters, and/or proceeding papers, discuss the characteristics of the concept/approach, its limitations, and benefits, submit a report, and present results of their independent study.

Effective Term Earliest Available
Effective Year Earliest Available
Rotating Topic?No
Repeatable Credit?No

Amount of Credit3

S/U Only?No
Contact Type Regularly Scheduled
Weekly Contact Hours 3
Course Description Application of nanotechnology in crop production, food processing and preservation, and environmental remediation; behavior of engineered nanoparticles in plant, soil and the environment, and environmental toxicology and regulations of engineered nanoparticles.
Prerequisites SWS 3022 - Intro to Soils in the Environment
Co-requisites None
Rationale and Placement in Curriculum Nanotechnology is at the forefront of many contemporary advances in science and engineering. A literacy in the topic is vital for students with trajectories toward food,agricultural, and natural resource conservation careers. We feel this course will help to bolster the curriculum to that end.
Course Objectives This course will cover the fundamentals of nanoscience and nanotechnology, application of nanotechnology in crop production, food processing and preservation, and environmental remediation; behavior of engineered nanoparticles in plant, soil and the environment, and environmental toxicology and regulations of engineered nanoparticles.

- Understand basic concepts, principles, and components of nanotechnology. At the end of the course all students will be able to describe basic theory of nanoscience and nanotechnology.

- Learn skills in the creation and characterization of nanomaterials. At the end of the course all

students will be familiar with methods for characterizing important properties of nanomaterials commonly used in agriculture and the environment.

• Familiar with application of nanotechnology in agriculture, food, and environment. At the end of the course all students will be able to apply nanotechnology to solve some problems in the fields of food, agriculture, and environment.

• Gain knowledge in toxicology of engineered nanoparticles (EPs) and current methods of assessment. At the end of the course all students will be able to understand potential impact of EPs and conduct simple environmental risk assessment.

Course Textbook(s) and/or Other Assigned Reading No textbook is required. Reference books, journal articles, and related information links are provided on
course website and in disk. Some examples of general readings that support several topics are listed as
follows:

Reference Books:

Poole Jr., C. A., and F. J. Owens (ed).2003.Introduction to nanotechnology. John Wiley & Sons, Hoboken, NJ, ISBN 0-471-07935-9.

Sellers, K., C. Mackay, L. L. Bergeson, S. R. Clough, M. Hoyt, J. Chen, K. Henry, and J. Hamblen (eds.). 2009. Nanotechnology and the Environment. CRC Press, Boca Raton, FL.

Wiesner, M. R. and J. Y. Bottero (ed). 2007. Environmental Nanotechnology: application and impacts of nanomaterials. The McGraw-Hill Co, New York.

Batley, G. E., J. K. Kirby, and M. J. McLaughlin. 2011. Fate and risks of nanomaterials in aquatic and terrestrial environments. Accounts of Chemical Research 46: 854-862.

Bergeson, L. L. 2013. Sustainable nanomaterials: Emerging governance systems. ACS Sustainable Chemistry and Engineering 1: 724-730.

Rico, C. M., S. Majumdar, M. Duarte-Gardea, J. R. Peralta-Videa, and J. L. Gardea-Teooresdey. 2011.
Interaction of nanoparticles with edible plants and their possible implications in the food chain. Journal of Agricultural and Food Chemistry 59: 3485-3498.

Weir, A, P. Westerhoff, L. Fabricius, K. Hristovski and N. von Goetz. 2012. Titanium dioxide nanoparticles in food and personal care products. Environmental Science and Technology 46: 2242-2250.

Weekly Schedule of Topics COURSE CHAPTERS
Nanotechnology in Agriculture, Food and Environment

Module I	Basic concepts and principles of nanotechnology
Chapter 1	Fundamentals of Nanoscience and Nanotechnology
Chapter 2	Nanoscale Materials: Definition and Properties
Chapter 3	Manufacturing and Characterization of Nanoparticles
Chapter 4	Natural Nanoparticles and Their Role in Soil and Water Quality
Module II	Nanotechnology Applications
Chapter 5	Nanotechnology Application in Agriculture

Chatper 6 Nanotechnology Application in Food Sciences

Chapter 7 Nanotechnology Application in the Environment

Module III Behavior, environmental toxicology and regulations of nanoparticle

Chatper 8 Environmental Fate and Transport of Engineered Nanoparticles

Chapter 9 Environmental Toxicology of Engineered Nanoparticles

Chapter 10 Environmental Regulation of Engineered Nanomaterials

Module IV Smart nano-delivery systems

Chapter 11 Smart Nanoscale Systems for Targeted Delivery of Drugs, Nutrients and Pesticides

Teaching schedule*

Week Topics covered Lectures/reading materials/assignments
1 Introduction/ historic development and fundamentals of nanoscience and nanotechnology Lecture 1/Chapter 1
Reading materials
Assignment 1

2 Nanoscale materials: definition and properties Lecture 2/Chapter 2
Reading materials
Assignment 2

3 Manufacturing and characterization of nanoparticles Lecture 3/Chapter 3
Reading materials
Assignment 3

4 Natural nanoparticles and their role in soil and water quality Lecture 4/Chapter 4
Reading materials

5 Nanotechnology application in agriculture I & II Lectures 5/Chapters 5
Reading materials
Assignment 5

6 Nanotechnology application in food sciences Lecture 6/Chapter 6
Reading materials
Assignment 5

7 Spring break

8 Nanotechnology application in the environment Lecture 7/Chapter 7
Reading materials
Assignment 6

9 Course review Mid-term exam

10 Environmental fate and transport of engineered nanomaterials Lecture 8/Chapter 8
Reading materials
Assignment 7

11 Environmental toxicology of engineered nanoparticles Lecture 9/Chapter 9
Reading materials
Assignment 8

12 Environmental regulation of engineered nanomaterial Lecture 10/Chapter 10
Reading materials

13 Smart Nanoscale Systems for Targeted Delivery of Drugs, Nutrients and Pesticides
Lecture 11/Chapter 11
Reading materials

14-15 Course review

16 Final exam
* Dates for topics or exams are subject to change.

Links and PoliciesGRADES AND GRADE POINTS: For information on current UF policies for assigning grade points, see https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

ABSENCES AND MAKE-UP WORK: Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

ACADEMIC HONESTY: As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.” You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment."
It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code.

SOFTWARE USE: All faculty, staff, and students of the University of Florida are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

CAMPUS RESOURCES:

Health and Wellness
U Matter, We Care:
If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.
Counseling and Wellness Center:
http://www.counseling.ufl.edu/cwc/Default.aspx, 392-1575;

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department, 392-1111 (or 9-1-1 for emergencies).
http://www.police.ufl.edu/

Academic Resources
E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
https://lss.at.ufl.edu/help.shtml.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling.

http://www.crc.ufl.edu/

Library Support, http://cms.uflib.ufl.edu/ask . Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. http://teachingcenter.ufl.edu/

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. http://writing.ufl.edu/writing-studio/

Student Complaints Campus: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf
On-Line Students Complaints: http://www.distance.ufl.edu/student-complaint-process

STUDENTS WITH DISABILITIES: The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, www.dso.ufl.edu/drc/) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

ONLINE COURSE EVALUATION: Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results/.

STUDENT COMPLAINTS: Each online distance learning program has a process for, and will make every attempt to resolve, student complaints within its academic and administrative departments at the program level. See http://distance.ufl.edu/student-complaints

Grading Scheme GRADING:

Homework/Quizzes:		30%
Chat room attendance	5%	
Mid-term Examination:	30%	
Final Examination		35%
Total		

100%

There will be no make-up homework and exams. Late submission of assignments will result in reduced credit (10% per assignment) if it is not agreed upon in advance.

A	94 – 100%
A-	90 – 93%
B+	87 – 89%
B	83 – 86%
B-	80 – 82%
C+	77 – 79%
C	73 – 76%
C-	70 – 72%
D+	67 – 69%
D	63 – 66%
D-	60 – 62%
E	

< 60%

Instructor(s) Dr. Zhenli L. He, Professor
University of Florida, IFAS, Indian River Research and Education Center, 2199 South Rock Road, Fort Pierce, FL. 34945
Tel 772-577-7353 Fax 772-468-5668
E-mail: zhe@ufl.edu

UF UNIVERSITY of FLORIDA

Institute of Food and Agricultural Sciences
Soil and Water Sciences Department

2181 McCarty Hall
PO Box 110290
University of Florida
Gainesville, FL 32611
Telephone: 352-294-3110
Fax: 352-392-3902
apatite@ufl.edu

June 26, 2017

Dear CALS Curriculum Committee:

We are requesting that the course entitled "Nanotechnology in Food, Agriculture, and Environment", currently awaiting assignment of a unique course number, be approved as a 4XXX/6XXX co-taught course. It broadly covers fundamentals of nanotechnology as it is applied to crop production, food processing and preservation, and environmental remediation. It also addresses behavior of nanoparticles in plants and soils, as well as toxicology and regulations of engineered nanoparticles. Nanotechnology is at the forefront of many contemporary advances in science and engineering. A literacy in the topic is vital for students with trajectories toward food-, agricultural-, and natural resource conservation careers. We feel this course will help to bolster the curriculum to that end. Another nanotechnology course (Nanotechnology in Water Research; ABE 6266) is taught in the Agricultural and Biological Engineering Department. Most of the ABE 6266 content focuses on water pollution and nanotechnology applications to wastewater treatment; hence, it is largely distinct from the emphasis of the proposed course.

Graduate students will have the additional requirement of an independent nanotechnology project for which they will select one of the nanotechnology application areas (food processing/preservation, agricultural production/nanofertilizers, soil and water quality, and environment-pollution control/toxicology, *etc.*). The project (20% of the course grade) will require writing and presenting a report that includes literature review and discussion of the concept, limitations, and benefits.

Dr. James Bonczek
Undergraduate Coordinator, Senior Lecturer, Soil and Water Sciences Department

W. G. Harris
Dr. Willie Harris
Graduate Coordinator, Professor, Soil and Water Sciences Department

The grading rubric for graduate student's final project

Components	Poor (≤ 60 %)	Acceptable (61-80 %)	Good (81-90 %)	Excellent (91-100 %)	Full score
Content					
Scientific questions	No obvious scientific questions to be addressed.	Scientific question is not explicitly presented.	There is a scientific question clearly stated.	Significant questions are logically addressed.	10
Hypothesis	No hypothesis.	There is hypothesis, but not well presented.	There is a well presented hypothesis.	Meaningful hypotheses are logically addressed.	5
Methodology	No experimental design and lack of adequate methods.	There is experimental design, but lack of adequate methods.	There is experiment design with measurement methods.	The experiments are statistically designed with adequate methods.	10
Data process & statistical analysis	No statistical analysis of the data.	There is statistical analysis of the data but not sufficient.	The data are statistically analyzed but not well presented.	The data are statistically analyzed and well presented.	5
Results and Discussion	Interpretation of the data is lacking.	The results are presented but not well discussed.	The results are adequately presented and discussed.	The results are well presented and discussed.	20
Communication					
Organization	No logical structure of the paper and presentation.	The paper and presentation is structured in a way but hard to follow.	The paper and presentation is logically structured.	Well organized with proper proportions of text, figures, and pictures.	10
Language	Poor with many errors in grammar and spelling.	Adequate with minor errors in grammar and spelling	Written clearly without obvious errors in grammar and spelling	Well written with good flow of ideas and easy to follow	10
Colors & figures	Colors are arbitrarily chosen and figures are poorly designed.	Use of some colors and figures to present information.	Colors and figures are used to enhance presentation.	Colors and figures are well designed to communicate ideas.	10
Presentation	Not clear and timely	Good speech but not timely	Good speech and timely	Well presented and timely	10
Acknowledgment	Minimal citation	With some citations and references	Completely cited and acknowledged.	Well cited and acknowledged with journal standards	10

NANOTECHNOLOGY IN FOOD, AGRICULTURE AND ENVIRONMENT (SWS 4XXX)

3 Credits- Every Spring

INSTRUCTOR: Dr. Zhenli L. He, Professor
University of Florida, IFAS, Indian River Research and Education Center,
2199 South Rock Road, Fort Pierce, FL. 34945
Tel 772-577-7353 Fax 772-468-5668
E-mail: *zhe@ufl.edu*

CATALOG DESCRIPTION:
Application of nanotechnology in crop production, food processing and preservation, and environmental remediation; behavior of engineered nanoparticles in plant, soil and the environment, and environmental toxicology and regulations of engineered nanoparticles.

PRE-REQUISITES/CO-REQUISITES:
Basic knowledge in soil sciences, environmental sciences, or equivalent courses in the related fields; SWS 3022 – Intro to Soils in the Environment

COURSE OBJECTIVES:
This course will cover the fundamentals of nanoscience and nanotechnology, application of nanotechnology in crop production, food processing and preservation, and environmental remediation; behavior of engineered nanoparticles in plant, soil and the environment, and environmental toxicology and regulations of engineered nanoparticles.

- Understand basic concepts, principles, and components of nanotechnology. At the end of the course all students will be able to describe basic theory of nanoscience and nanotechnology.
- Learn skills in the creation and characterization of nanomaterials. At the end of the course all students will be familiar with methods for characterizing important properties of nanomaterials commonly used in agriculture and the environment.
- Familiar with application of nanotechnology in agriculture, food, and environment. At the end of the course all students will be able to apply nanotechnology to solve some problems in the fields of food, agriculture, and environment.
- Gain knowledge in toxicology of engineered nanoparticles (EPs) and current methods of assessment. At the end of the course all students will be able to understand potential impact of EPs and conduct simple environmental risk assessment.

DELIVERY METHOD: Online-Canvas E-Learning System and audio/video lectures (with powerpoint presentations and reading materials)

OFFICE HOURS*:* Open for e-mail and phone call at any time or chat room by appointment.

FREQUENCY: Spring semester, every year

TARGET STUDENTS: Undergraduate students who wish to expand their knowledge in emerging sciences and become a specialist in food, agriculture, and environment.

CLASS ATTENDANCE: **Attendance of chat sessions is mandatory.** There is 5% grade for chat room participation.

CHAT ROOM SESSION: Chat room session is scheduled 5-7 PM every Tuesday except for public holidays.

GRADING:

Homework/Quizzes:	30%
Chat room attendance	5%
Mid-term Examination:	30%
Final Examination	35%
Total	100%

Students are responsible for satisfying all academic objectives as defined by the instructor. Absences count from the first class meeting.

A	94 – 100%
A-	90 – 93.9%
B+	87 – 89.9%
B	83 – 86.9%
B-	80 – 82.9%
C+	77 – 79.9%
C	73 – 76.9%
C-	70 – 72.9%
D+	67 – 69.9%
D	63 – 66.9%
D-	60 – 62.9%
E	< 60%

ASSIGNMENTS/ EXAMS/PROJECTS: Nanotechnology is one of the rapidly-developing frontiers with application in many fields including food, agriculture /LECTURES and environment. This course involves new concepts, principles, application, and measurements. It is important that the students have a good understanding of the concepts and principles. Therefore, in addition to lectures, the students will be also provided with supplementary course materials to read and homework to do at the end of each chapter. The students are required to submit homework report timely in order to obtain scores. The mid-term examination is designed to check the study progresses of each student so that some adjustment can be made based on student's performance. All the students are required to take final examination, which is used to indicate the learning efficacy and accomplishments of each student.

TEXTBOOK/REFERENCES:
No textbook is required. Reference books, journal articles, and related information links are provided on course website and in disk. Some examples of general readings that support several topics are listed as follows:

Reference Books:

Poole Jr., C. A., and F. J. Owens (ed).2003.Introduction to nanotechnology. John Wiley & Sons, Hoboken, NJ, ISBN 0-471-07935-9.

Sellers, K., C. Mackay, L. L. Bergeson, S. R. Clough, M. Hoyt, J. Chen, K. Henry, and J. Hamblen (eds.). 2009. Nanotechnology and the Environment. CRC Press, Boca Raton, FL.

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Weir, A, P. Westerhoff, L. Fabricius, K. Hristovski and N. von Goetz. 2012. Titanium dioxide nanoparticles in food and personal care products. *Environmental Science and Technology* 46: 2242-2250.

COURSE CHAPTERS

Nanotechnology in Agriculture, Food and Environment

Module I	**Basic concepts and principles of nanotechnology**
Chapter 1	Fundamentals of Nanoscience and Nanotechnology
2	Nanoscale Materials: Definition and Properties
3	Manufacturing and Characterization of Nanoparticles
4	Natural Nanoparticles and Their Role in Soil and Water Quality
Module II	**Nanotechnology Applications**
5	Nanotechnology Application in Agriculture
6	Nanotechnology Application in Food Sciences
7	Nanotechnology Application in the Environment
Module III	**Behavior, environmental toxicology and regulations of nanoparticle**
8	Environmental Fate and Transport of Engineered Nanoparticles
9	Environmental Toxicology of Engineered Nanoparticles
10	Environmental Regulation of Engineered Nanomaterials
Module IV	**Smart nano-delivery systems**
11	Smart Nanoscale Systems for Targeted Delivery of Drugs, Nutrients and Pesticides

Teaching schedule*

Week	Topics covered	Lectures/reading materials/assignments
1	Introduction/ historic development and fundamentals of nanoscience and nanotechnology	Lecture 1/Chapter 1 Reading materials Assignment 1
2	Nanoscale materials: definition and properties	Lecture 2/Chapter 2 Reading materials Assignment 2

3	Manufacturing and characterization of nanoparticles	Lecture 3/Chapter 3 Reading materials Assignment 3
4	Natural nanoparticles and their role in soil and water quality	Lecture 4/Chapter 4 Reading materials
5	Nanotechnology application in agriculture I & II	Lectures 5/Chapters 5 Reading materials Assignment 5
6	Nanotechnology application in food sciences	Lecture 6/Chapter 6 Reading materials Assignment 5
7		Spring break
8	Nanotechnology application in the environment	Lecture 7/Chapter 7 Reading materials Assignment 6
9	Course review	Mid-term exam
10	Environmental fate and transport of engineered nanomaterials	Lecture 8/Chapter 8 Reading materials Assignment 7
11	Environmental toxicology of engineered nanoparticles	Lecture 9/Chapter 9 Reading materials Assignment 8
12	Environmental regulation of engineered nanomaterial	Lecture 10/Chapter 10 Reading materials
13	Smart Nanoscale Systems for Targeted Delivery of Drugs, Nutrients and Pesticides	Lecture 11/Chapter 11 Reading materials
14-15	Course review	
16	Final exam	

* Dates for topics or exams are subject to change.

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exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code.

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If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.
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Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department, 392-1111 (or 9-1-1 for emergencies).
http://www.police.ufl.edu/

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575,
www.counseling.ufl.edu/cwc/
Counseling Services
Groups and Workshops
Outreach and Consultation
Self-Help Library
Wellness Coaching

U Matter We Care, www.umatter.ufl.edu/
Career Resource Center, First Floor JWRU, 392-1601, www.crc.ufl.edu/

Library Support, http://cms.uflib.ufl.edu/ask . Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. http://teachingcenter.ufl.edu/

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. http://writing.ufl.edu/writing-studio/

Student Complaints Campus: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf

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NANOTECHNOLOGY IN FOOD, AGRICULTURE AND ENVIRONMENT (SWS 6XXX)

3 Credits- Every Spring

INSTRUCTOR: Dr. Zhenli L. He, Professor
University of Florida, IFAS, Indian River Research and Education Center,
2199 South Rock Road, Fort Pierce, FL 34945
Tel 772-577-7353 Fax 772-468-5668
E-mail: *zhe@ufl.edu*

CATALOG DESCRIPTION:
Application of nanotechnology in crop production, food processing and preservation, and environmental remediation; behavior of engineered nanoparticles in plant, soil and the environment, and environmental toxicology and regulations of engineered nanoparticles.

PRE-REQUISITES/CO-REQUISITES:
Basic knowledge in soil sciences, soil and water chemistry, environmental sciences or equivalent courses in the related fields; SWS 5050 – Soils for Environmental Professionals

COURSE OBJECTIVES:
This course will cover the fundamentals of nanoscience and nanotechnology, application of nanotechnology in crop production, food processing and preservation, and environmental remediation; behavior of engineered nanoparticles in plant, soil and the environment, and environmental toxicology and regulations of engineered nanoparticles.

- Understand basic concepts, principles, and components of nanotechnology. At the end of the course all students will be able to describe basic theory of nanoscience and nanotechnology.
- Develop skills in the creation and characterization of nanomaterials. At the end of the course all students will be familiar with methods for characterizing important properties of nanomaterials commonly used in agriculture and the environment.
- Gain expertise in application of nanotechnology in agriculture, food, and environment. At the end of the course all students will be able to apply nanotechnology to solve some problems in the fields of food, agriculture, and environment.
- Learn toxicology of engineered nanoparticles (EPs) and current methods of assessment. At the end of the course all students will be able to understand potential impact of EPs and conduct simple environmental risk assessment.

DELIVERY METHOD: Online-Canvas E-Learning System and audio/video lectures (with powerpoint presentations and reading materials)

OFFICE HOURS*:* Open for e-mail and phone call at any time or chat room by appointment.

FREQUENCY: Spring semester, every year

TARGET STUDENTS: Graduate students who wish to expand their knowledge in emerging sciences and become a specialist in food, agriculture, and environment.

CLASS ATTENDANCE: **Attendance of chat sessions is mandatory.** There is 5% grade for chat room participation.

CHAT ROOM SESSION: Chat room session is scheduled 5-7 PM every Tuesday except for public holidays.

GRADING:

Homework/Quizzes:	30%
Chat room attendance	5%
Mid-term Examination:	20%
Project	20%
Final Examination	25%
Total	100%

Students are responsible for satisfying all academic objectives as defined by the instructor. Absences count from the first class meeting.

A	94 – 100%
A-	90 – 93.9%
B+	87 – 89.9%
B	83 – 86.9%
B-	80 – 82.9%
C+	77 – 79.9%
C	73 – 76.9%
C-	70 – 72.9%
D+	67 – 69.9%
D	63 – 66.9%
D-	60 – 62.9%
E	< 60%

ASSIGNMENTS/ EXAMS/PROJECTS: Nanotechnology is one of the rapidly-developing frontiers with application in many fields including food, agriculture /LECTURES and environment. This course involves new concepts, principles, application, and measurements. It is important that the students have a good understanding of the concepts and principles. Therefore, in addition to lectures, the students will be also provided with supplementary course materials to read and homework to do at the end of each chapter. The students are required to submit homework report timely in order to obtain scores. The mid-term examination is designed to check the study progresses of each student so that some adjustment can be made based on student's performance. In this course, each student is required to conduct an independent nanotechnology project. For this project, students will select one of the nanotechnology application areas (food processing/preservation, agricultural production/nanofertilizers, soil and water quality, and environment-pollution control/toxicology, *etc*.), conduct a literature review based on journal articles, book chapters, and/or proceeding papers, discuss the characteristics of the concept/approach, its limitations, and benefits, submit a report, and present results of their independent study.

TEXTBOOK/REFERENCES:

No textbook is required. Reference books, journal articles, and related information links are provided on course website and in disk. Some examples of general readings that support several topics are listed as follows:

Reference Books:

Poole Jr., C. A., and F. J. Owens (ed).2003.Introduction to nanotechnology. John Wiley & Sons, Hoboken, NJ, ISBN 0-471-07935-9.

Sellers, K., C. Mackay, L. L. Bergeson, S. R. Clough, M. Hoyt, J. Chen, K. Henry, and J. Hamblen (eds.). 2009. Nanotechnology and the Environment. CRC Press, Boca Raton, FL.

Wiesner, M. R. and J. Y. Bottero (ed). 2007. Environmental Nanotechnology: application and impacts of nanomaterials. The McGraw-Hill Co, New York.

Batley, G. E., J. K. Kirby, and M. J. McLaughlin. 2011. Fate and risks of nanomaterials in aquatic and terrestrial environments. *Accounts of Chemical Research* 46: 854-862.

Bergeson, L. L. 2013. Sustainable nanomaterials: Emerging governance systems. *ACS Sustainable Chemistry and Engineering* 1: 724-730.

Rico, C. M., S. Majumdar, M. Duarte-Gardea, J. R. Peralta-Videa, and J. L. Gardea-Teooresdey. 2011. Interaction of nanoparticles with edible plants and their possible implications in the food chain. *Journal of Agricultural and Food Chemistry* 59: 3485-3498.

Weir, A, P. Westerhoff, L. Fabricius, K. Hristovski and N. von Goetz. 2012. Titanium dioxide nanoparticles in food and personal care products. *Environmental Science and Technology* 46: 2242-2250.

Journal Articles:

1. National Science and Technology Council, 2000. National Nanotechnology Initiative: Leading to the next industrial revolution. A report by the Interagency Working Group on Nanoscience, Engineering and Technology. Washington, D.C.

2. ASTM International, 2006. Designation: E 2456-06. Standard Terminology Relating to Nanotechnology.

3. Wang, Z.L., Y. Liu, and Z. Zhang. (Ed.). 2002. Handbook of Nanophase and Nanostructured Materials: Synthesis/ Characterization / Materials Systems and Applications I/Materials Systems and Applications II. Springer Science & Business Media.

4. Bakshi S. et al, 2015. Natural nanoparticles: implications for environment and human health. *Critical Reviews in Environmental Science and Technology* 45:861–904

5. Hartland A. et al, 2013. The Environmental Significance of Natural Nanoparticles. *Nature Education Knowledge* 4(8):7

6. Sharma et al. 2015. Natural inorganic nanoparticles–formation, fate, and toxicity in the environment. Chemical Society Reviews 44: 8410-8423.

7. Sekhon, B. S. 2014. Nanotechnology in agri-food production: an overview. *Nanotechnology, Science and Applications* 7, 31.

8. Mousavi, S. R., & Rezaei, M. 2011. Nanotechnology in agriculture and food production. J Appl Environ Biol Sci, 1(10), 414-419.

9. Gogos, A., Knauer, K., and Bucheli, T.D. 2012. Nanomaterials in plant protection and fertilization: current state, foreseen applications and research priorities. *J. Agric. Food Chem.* 60: 9871-9792.

10. Weiss J., P. Takhistov, and D. J. McClements. 2006. Functional materials in food nanotechnology. *J. Food Sci.* 71:R107-R116.

11. Habuda-Stanic M. and M. Nujic. 2015. Arsenic removal by nanoparticles: a review. Environ. Sci. Pollut. Res. 22: 8094-8123.

12. Kasaraneni V. R., L. A. Schifman, T. B. Boving, and V. Oyanedel-Craver. 2014. Enhancement of surface runoff quality using modified sorbents. *Sustainable Chem. & Eng*. 2: 1609-1615.

13. Upadhyayula et al. 2009. Application of carbon nanotube technology for removal of contaminants in drinking water: a review. *Science of the Total Environment* 408: 1-13.

14. Klaine, S. J., Alvarez, P. J., Batley, G. E., Fernandes, T. F., Handy, R. D., Lyon, D. Y., & Lead, J. R. 2008. Nanomaterials in the environment: behavior, fate, bioavailability, and effects. *Environmental Toxicology and Chemistry* 27(9), 1825-1851.

15. Lin D et al. 2010. Fate and transport of engineered nanomaterials in the environment. Journal of Environmental Quality 39: 1896-1908.

16. Zhu et al. 2012. Effect of surface charge on the uptake and distribution of gold nanoparticles in four plant species. Environmental Science & Technology 46: 12391-12398.

17. Bergeson, L. L. 2013. Sustainable nanomaterials: emerging governance systems. ACS Sustainable Chemistry & Engineering 1: 724-730.

18. Rico C. M. et al. 2015. Physiological and biochemical response of soil-grown barley (Hordeum vulgare L.) to cerium oxide nanoparticles. Environ Sci Pollut Res 22:10551–10558.

19. Gonzalez-Melendi, P. et al. 2008. Nanoparticles as smart treatment-delivery systems in plants: assessment of different techniques of microscopy for their visualization in plant tissues. Annals of Botany 101: 187–195.

20. TASCIOTTI, E. et al. 2008. Mesoporous silicon particles as a multistage delivery system for imaging and therapeutic applications. Nature nanotechnology 3: 151-157.

COURSE CHAPTERS

Nanotechnology in Agriculture, Food and Environment

Module I **Basic concepts and principles of nanotechnology**

Chapter 1 Fundamentals of Nanoscience and Nanotechnology

2 Nanoscale Materials: Definition and Properties

3 Manufacturing and Characterization of Nanoparticles

4 Natural Nanoparticles and Their Role in Soil and Water Quality

Module II **Nanotechnology Applications**

5 Nanotechnology Application in Agriculture

6 Nanotechnology Application in Food Sciences
7 Nanotechnology Application in the Environment

Module III Behavior, environmental toxicology and regulations of nanoparticle

8 Environmental Fate and Transport of Engineered Nanoparticles
9 Environmental Toxicology of Engineered Nanoparticles
10 Environmental Regulation of Engineered Nanomaterials

Module IV Smart nano-delivery systems

11 Smart Nanoscale Systems for Targeted Delivery of Drugs, Nutrients and Pesticides

Teaching schedule*

Week	Topics covered	Lectures/reading materials/assignments
1	Introduction/ historic development and fundamentals of nanoscience and nanotechnology	Lecture 1/Chapter 1 Reading materials Assignment 1
2	Nanoscale materials: definition and properties	Lecture 2/Chapter 2 Reading materials Assignment 2
3	Manufacturing and characterization of nanoparticles	Lecture 3/Chapter 3 Reading materials Assignment 3
4	Natural nanoparticles and their role in soil and water quality	Lecture 4/Chapter 4 Reading materials
5	Nanotechnology application in agriculture I & II	Lectures 5/Chapters 5 Reading materials Assignment 5
6	Nanotechnology application in food sciences	Lecture 6/Chapter 6 Reading materials Assignment 5
7		Spring break
8	Nanotechnology application in the environment	Lecture 7/Chapter 7 Reading materials Assignment 6
9	Course review	Mid-term exam
10	Environmental fate and transport of engineered nanomaterials	Lecture 8/Chapter 8 Reading materials Assignment 7
11	Environmental toxicology of engineered nanoparticles	Lecture 9/Chapter 9 Reading materials Assignment 8
12	Environmental regulation of engineered nanomaterial	Lecture 10/Chapter 10 Reading materials
13	Smart Nanoscale Systems for Targeted Delivery of Drugs, Nutrients and Pesticides	Lecture 11/Chapter 11 Reading materials
14-15	Course review	

16 Final exam

* Dates for topics or exams are subject to change.

GRADES AND GRADE POINTS: For information on current UF policies for assigning grade points, see https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

ABSENCES AND MAKE-UP WORK: Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx.

ACADEMIC HONESTY: As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity." You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment."

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code.

SOFTWARE USE: All faculty, staff, and students of the University of Florida are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

CAMPUS RESOURCES:

Health and Wellness

U Matter, We Care:
If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.
Counseling and Wellness Center:
http://www.counseling.ufl.edu/cwc/Default.aspx, 392-1575;

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department, 392-1111 (or 9-1-1 for emergencies).
http://www.police.ufl.edu/

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu, https://lss.at.ufl.edu/help.shtml.

University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575, www.counseling.ufl.edu/cwc/
Counseling Services
Groups and Workshops
Outreach and Consultation
Self-Help Library
Wellness Coaching

U Matter We Care, www.umatter.ufl.edu/

Career Resource Center, First Floor JWRU, 392-1601, www.crc.ufl.edu/

Library Support, http://cms.uflib.ufl.edu/ask . Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. http://teachingcenter.ufl.edu/

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. http://writing.ufl.edu/writing-studio/

Student Complaints Campus: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf
On-Line Students Complaints: http://www.distance.ufl.edu/student-complaint-process

STUDENTS WITH DISABILITIES: The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, www.dso.ufl.edu/drc/) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

ONLINE COURSE EVALUATION: Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results/.

STUDENT COMPLAINTS: Each online distance learning program has a process for, and will make every attempt to resolve, student complaints within its academic and administrative departments at the program level. See http://distance.ufl.edu/student-complaints for more details.

The grading rubric for graduate student's final project

Components	Poor (≤ 60 %)	Acceptable (61-80 %)	Good (81-90 %)	Excellent (91-100 %)	Full score
Content					
Scientific questions	No obvious scientific questions to be addressed.	Scientific question is not explicitly presented.	There is a scientific question clearly stated.	Significant questions are logically addressed.	10
Hypothesis	No hypothesis.	There is hypothesis, but not well presented.	There is a well presented hypothesis.	Meaningful hypotheses are logically addressed.	5
Methodology	No experimental design and lack of adequate methods.	There is experimental design, but lack of adequate methods.	There is experiment design with measurement methods.	The experiments are statistically designed with adequate methods.	10
Data process & statistical analysis	No statistical analysis of the data.	There is statistical analysis of the data but not sufficient.	The data are statistically analyzed but not well presented.	The data are statistically analyzed and well presented.	5
Results and Discussion	Interpretation of the data is lacking.	The results are presented but not well discussed.	The results are adequately presented and discussed.	The results are well presented and discussed.	20
Communication					
Organization	No logical structure of the paper and presentation.	The paper and presentation is structured in a way but hard to follow.	The paper and presentation is logically structured.	Well organized with proper proportions of text, figures, and pictures.	10
Language	Poor with many errors in grammar and spelling.	Adequate with minor errors in grammar and spelling	Written clearly without obvious errors in grammar and spelling	Well written with good flow of ideas and easy to follow	10
Colors & figures	Colors are arbitrarily chosen and figures are poorly designed.	Use of some colors and figures to present information.	Colors and figures are used to enhance presentation.	Colors and figures are well designed to communicate ideas.	10
Presentation	Not clear and timely	Good speech but not timely	Good speech and timely	Well presented and timely	10
Acknowledgment	Minimal citation	With some citations and references	Completely cited and acknowledged.	Well cited and acknowledged with journal standards	10