ENVIRONMENTAL NANOSCIENCE

GEOL4315/CRN27461
GEOL5315/CRN26141

INSTRUCTOR: Jie Xu, Ph.D.
Geological Sciences 319,
915-747-7556
jxu2@utep.edu

LECTURES: Thursdays 6:00 pm -8:50 pm, Geological Sciences #302

OFFICE HOURS: By appointment. (You are welcome to stop in if my door is open.)

COURSE REFERENCES:
There is no requirement for textbooks for this class, but we will have many reading assignments. The reading materials for in-class discussion will be posted on *Blackboard*. Please sign in to check them as well as other announcements. Other suggested references include:

Nature's Nanostructures, (Eds.) A. S. Barnard, H. Guo (ISBN 9789814316828)
Introduction to Nanoscience, S.M. Lindsay (ISBN 9780199544219)
Environmental Nanotechnology: Applications and Impacts of Nanomaterials, 2nd edition, (the link to the e-book is attached below)
https://www.accessengineeringlibrary.com/browse/environmental-nanotechnology-applications-and-impacts-of-nanomaterials-second-edition
Nanoscience and Nanotechnology: Environmental and Health Impacts, (Ed.) by W.H. Grassian (ISBN 9780470081037)

COURSE DESCRIPTION:
Nanoscience is a rapidly growing frontier area of research that has been contributing to a revamping of all sciences. Currently, the Earth and environmental sciences are under-represented in their participation in this revolutionary field of study. Are we Earth and environmental majors really that far from nanoscience? Multiple lines of growing evidence show that nanoscale materials are intrinsic components of almost all natural scenarios. Also, the extensive use of nanotechnology in consumer products will inevitably influence our environment with more and more detected of unexpected engineered nanostructures in our oceans, riverbeds, groundwater, and soils, etc.

This cross-listed course aims to introduce the Earth and environmental sciences community into the field of nanoscience and connect them with the latest information on environmental nanoscience findings. There are four major modules for this course: (1) fundamental principles of nanoscience: what makes nanoscale materials so special and why these tiny structures can be formed, especially in nature?; (2) instrumentation and facilities for characterization of nanomaterials in the environment; (3) the distribution and behavior of natural and anthropogenic nanomaterials in the environment (including the atmosphere, the hydrosphere, the pedosphere, and the biosphere); and (4) applications of nanomaterials/nanotechnology in the contexts of environmental remediation, energy recovery, and agricultural control.

LEARNING GOALS:

Environmental nanoscience is a relatively new field, and some of the references we use are publications within the past decade. Thus, I would encourage the enrolled students, either undergraduate or graduate, to adopt an open attitude: meaning - be ready to challenge the status quo and add new questions and insights to the field once you have learnt about it. The goals of learning are listed below:

Knowledge-wise

● To obtain an overview of nanoscience and how size-reduction can lead to dramatic changes in the material's physicochemical properties
● To stay current about data repositories, tools, and new research directions related to environmental nanoscience
● To comprehend the fundamentals of "big" science questions related to environmental nanoscience: e.g., the occurrence of nanomaterials in the environment, and impacts of nanomaterials on biogeochemical cycles, ecosystems and human health

Skill-wise

● To be familiar with the resources and where to obtain up-to-date information on the topic
● To be able to extract information quickly from a scientific journal or other equivalents
● To collaborate with peers productively to complete a shared task
● To efficient in communicating scientific information to the lay audience in both oral and written forms

GRADE COMPONENT AND GRADING POLICIES:

Please be aware that the grade components and grading policy are different for the enrolled undergraduate and graduate students. For undergraduate students, the final grade is composed of participation (10%), in-class projects grade (10% × 3) and final exam grade (60%). For graduate student, the final grade is composed of participation (10%), in-class project grade (10% × 3) and term paper grade (60%). If your final grade is in the range of > 90% - A; 89-80% - B; 79-70% - C, 69-60% - D; < 60% - F.

	Undergraduate	Graduate
Participation	10%	10%
In-class projects	10% × 3	10% × 3
Final exam	60%	-
Term paper	-	60%
Total	100%	100%

● **Final exam:** the final test will be a take-home, open-book one. The deadline will be given. Beware of the honor codes. Each student is required to complete the test independently.
● **Term paper**: the graduate students can choose a topic relevant to their research to work on. The length of the final paper is no shorted than 4 pages and no longer than 8 pages (1.5-line spaced, font size ≥ 11, bibliography separated from the 4-8 pages of main text). Instructions on how to write the term paper will be given in class during the sixth week.

● **Honor codes**: academic integrity is the fundament principle for all UTEP students, staff and faculty. Refer to the UTEP Student Handbook where scholastic dishonesty is defined (http://sa.utep.edu/osccr/academic-integrity/). Proven violations of these detailed regulations may result in any of the consequences outlined in the Handbook.
● **Plagiarism:** Using another person's ideas, words, drawings, etc. without giving proper credit (through a citation) is considered plagiarism. This includes anything from a book, magazine, technical report or journal, or website. It ALSO includes anything copied from another student's paper or from a paper you wrote for another class where you received credit for it. Plagiarism is considered *Academic Dishonesty* and you may be reported to the Dean of Students if I suspect you of plagiarism. Please see additional material at the Blackboard site on how to properly cite references.

DROP/WITHDRAWAL DATE:
The UTEP Spring 2019 drop deadline is April 5, 2019. Any drop requests after this date will not be approved by the College of Science. Please double-check with the university and college offices as the dates may change following the initial announcement.

STUDENTS WITH DISABILITIES:
If you have a disability and may need accommodations in this class, you are encouraged to contact the Center for Accommodations and Support Services (CASS) at 915-747-5148 or cass@utep.edu within the first two weeks of class. Here is the link to the resources available to students with disabilities http://admin.utep.edu/Default.aspx?tabid=61021&submenuheader=2.

Week	*Date*	*Topic*
1	Jan 24	Self-introduction Syllabus Introduction of *Web of Science* Overview of the scope of environment nanoscience
2	Jan 31	Introduction to interfacial chemistry Basics of interfaces Surface tension Solid-liquid interfacial chemistry Examples on Interfaces of nanoscale systems Discussion of typical problems to enhance comprehension
3	Feb 7	Why physics of small systems is different? Milestones in quantum mechanics Quantum nature Quantum consequences Discussion of typical problems and examples to enhance comprehension
4	Feb 14	Wrap-up of previous two lectures Examples to enhance comprehension In-class project I
5	Feb 21	Principles for nanostructure formation Bottom-up and top-down Self-assembly of nanostructures Example: Fe-oxyhydroxides
6	Feb 28	Discussion of term paper requirements (for graduate students) How do we detect and characterize nanomaterials in the environment –analytical tools 1. FFF separation systems 2. Single particle ICP-MS
7	Mar 7	3. Dynamic light scattering-based technique Discussion of applications in different scenarios 4. X-ray/neutron based techniques Discussion of applications
8	Mar 14	5. Electron microscopy Discussion of applications
9	Mar 21	*Spring break – No class*
10	Mar 28	Lab visit (this will be arranged during day time in lieu of the evening class time, this class will be shortened to 1hr20min) In-class project II
11	Apr 4	The occurrence of natural and anthropogenic nanomaterials in the environment – a review of existing findings
12	Apr 11	In-class project III
13	Apr 18	Application of nanoscience and nanotechnology in agriculture, environmental remediation, and energy recovery

14	Apr 25	Toxicological impacts of nanomaterials on human health and associated ecosystems Handout of take-home exam (for undergraduate students)
15	May 2	Peer review of term papers
16	May 9	Challenges in Environmental Nanoscience Term paper due Take-home exam due

The actual schedule is subject to modifications.