APPROVED

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MAR – 8 2015
COLLEGE OF GRADUATE STUDIES

The University Of Toledo

New Graduate Course Proposal

* denotes required fields

1. College*: College of Engineering

   Department*: Civil Engineering

2. Contact Person*: Liangbo Hu Phone: 530-8124 (xxx - xxxx) Email: liangbo.hu@utoledo.edu

3. Alpha/Numeric Code (Subject area - number)*: CIVE - 8280

4. Proposed title*: Environmental and Energy C

   Proposed effective term*: 201610 (e.g. 201140 for 2011 Fall)

5. Is the course cross-listed with another academic unit? ~~Yes~~ √ No

   Approval of other academic unit (signature and title)

   Is the course offered at more than one level? √ Yes ~~No~~ CIVE 6280

   If yes, an undergraduate course proposal form must also be submitted. If the undergraduate course is new, complete the New Undergraduate Course Proposal; if the undergraduate course is existing, submit an Undergraduate Course Modification Proposal.

6. Credit hours*: Fixed: 3 or Variable: to

7. Delivery Mode:

	Primary*	Secondary	Tertiary
a. Activity Type *	Lecture	--SelectType--	--SelectType--
b. Minimum Credit Hours *	3		
Maximum Credit Hours *	3		
c. Weekly Contact Hours *	3		

8. Terms offered: ☐ Fall ☑ Spring ☐ Summer

   Years offered: ○ **Every Year** ◉ **Alternate Years**

9. Are students permitted to register for more than one section during a term? ◉ No ○ Yes

   May the courses be repeated for credit? ◉ No ○ Yes Maximum Hours

10. Grading System*:
    - ◉ Normal Grading (A-F, S/U, WP/WF, PR, I)
    - ○ Satisfactory/Unsatisfactory (A-C, less than C)
    - ○ Grade Only (A-F, WP/WF, PR, I)
    - ○ Audit Only
    - ○ No Grade

11. Prerequisites (must be taken **before**): i.e. C or higher in (BIOE 4500 or BIOE 5500) and C or higher in MATH 4200

Graduate standing

PIN (Permisson From Instructor) PDP (Permission From Department)

Co-requisites (must be taken **together**):

12. Catalog Description* (**75 words Maximum**)

This course is designed for engineering and geoscience students who want to explore a broad range of engineering challenges that emerge at the interface of materials, environment and energy. This course is aimed to provide advanced students with fundamental knowledge for understanding and modelling many complex phenomena involved in a variety of engineering applications. These include technologies of nuclear and hazardous waste disposal, unconventional petroleum and gas extraction, CO2 sequestration and geothermal energy.

13. Attach a syllabus and an electronic copy of a complete outline of the major topics covered. Click here for template.

File Type	View File
Syllabus	View

14. Comments/Notes:

15. Rationale:

This course is designed for engineering and geoscience students who want to explore a broad range of engineering challenges that emerge at the interface of materials, environment and energy.
The prediction of long-term effects of physico-chemical processes on the mechanical performance of geomaterials has become an important part of the environmental impact and sustainability assessment. This course is aimed to provide advanced students with fundamental knowledge and techniques for understanding and modelling many complex phenomena, usually of multi-scale and multi-physics in nature, involved in a variety of engineering applications.

Course Approval:

		Date
Department Curriculum Authority:	Ashok Kumar	2014/12/01
Department Chairperson:	Ashok Kumar	2014/12/01
College Curriculum Authority or Chair:	Efstratios Nikolaidis	2015/03/06
College Dean:	Mohamed Samir Hefzy	2015/03/08
Graduate Council:		2015/05/12 GC 4.21.2015

Dean of Graduate Studies: Date 5-12-2015

Office of the Provost : Date

print

Administrative Use Only

Effective Date: (YYYY/MM/DD)
CIP Code:
Subsidy Taxonomy:
Program Code:
Instructional Level:

Registrar's Office Use Only

Processed in Banner on:
Processed in Banner by:
Banner Subject Code:
Banner Course Number:
Banner Term Code:
Banner Course Title:

CIVE 6280/8280: Environmental and Energy Geotechnology

Department of Civil Engineering
University of Toledo

Spring 2016

Instructor: Liangbo Hu, Ph.D. (Liangbo.Hu@utoledo.edu)
Office Hours: W 15:00-17:00, 3023 Nitschke Hall, or by appointment, 530-8124

Course Topics

1. Part I: Fundamentals
    - mathematics fundamentals: matrices and tensors
    - basics of continuum mechanics
    - basics of mass and energy conservation laws for geo-environmental applications
2. Part II: Environmental and Energy Geotechnology
    - soil-infrastructure interaction
    - nature of soil and environment
    - soil technology
    - soil-water-air interaction in the environment
    - geo-hazards
    - geological storage of CO2
    - geological disposal of nuclear and hazardous waste
    - geothermal energy
3. Part III: Various Numerical Methods

This course is designed for engineering and geoscience students who want to explore a broad range of engineering challenges that emerge at the interface of materials, environment and energy. The prediction of long-term effects of physico-chemical processes on the mechanical performance of geomaterials has become an important part of the environmental impact and sustainability assessment. This course is aimed to provide advanced students with fundamental knowledge and techniques for understanding and modelling many complex phenomena, usually of multi-scale and multi-physics in nature, involved in a variety of engineering applications. These include technologies of nuclear and hazardous waste disposal, petroleum and gas extraction, CO2 sequestration and geothermal energy, as well as assessments of weathering of rock masses and structural materials, swelling of clayey soils and durability of pavement materials, to mention just a few.

Course Materials

Lecture notes and reading materials: distributed in classes.

Grading

50%	Homework
50%	Project

Homework. Each homework is, in general, due in one week.

- For Ph.D. students, each homework assignment will include $1 \sim 2$ problems (indicated by *) in addition to the regular part of the assignment.

Project. A final project report is due at the end of the semester and each student is required to give a 15-min presentation. (You are encouraged to discuss your choice of the project topic with the instructor by the mid term. You are free to propose any topic relevant to the context of this course.)

- Ph.D. students are expected to submit a mid-term paper reviewing the research context of the proposed project topic.

References

- Continuum Mechanics, Fridtjov Irgens. Springer, 2008. Free eBook (PDF format) available form UT library website.
- Fundamentals of Structural Mechanics, Keith D. Hjelmstad. 2nd ed., Springer, 2010.
- Soil Behavior and Critical State Soil Mechanics, David M. Wood. Cambridge University Press, 1990.
- Transport Phenomena in Biological Systems, George A. Truskey, Fan Yuan, David F. Katz. 2nd ed., Prentice Hall, 2009.
- Introduction to Environmental Geotechnology, Hsai-Yang Fang, John Daniels. 1st ed., CRC Press, 1997.
- Fundamentals of Soil Behavior, James K. Mitchell, Kenichi Soga. 3rd ed., Wiley, 2005.