Course Number: ERE339
Course Title: Fluid Mechanics

New Course

Prefix
Number
Credits
Title

Description
Pre-requisite(s)
Co-requisite(s)

Shared Resources
Course Format
Content
Semester Offered

For new courses only, indicate if you would like approval as a course meeting the General Education standards in the following knowledge and skills area (check all that apply):

American History
The Arts
Basic Communication

Humanities
Mathematics
Natural Sciences

Other World Civilizations
Social Sciences
Western Civilization

Other

If changing an existing course, describe the change(s):

___________________________________________________________________________________

List any pre- or co-requisites here: Calculus II (APM206) and Statics and Dynamics (GNE172)

Institutional Impact:

Anticipated Enrollment: 30-40 per semester

Technology and Classroom Resource Demands: Computer, digital projector, student desks with writing surfaces, multiple dry erase or chalk boards

Computing Resources: Blackboard software

Library Resources: Course reserve materials

Transportation Requirements: none

Forest Properties or Field Practicum Facilities Required: Flume, hydraulics benches, pressure transducers, and assorted pipes, tubes, and valves for constructing demonstrations and experiments. Materials are currently available in the ERE hydraulics laboratory.

Proposer Contact Information:

Name: Stephen Shaw
Department: ERE

Email: sbshaw@esf.edu
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Chair/Coordinator Signature: [Signature]
Health and Safety Considerations:

Conditions or situations present in association with the course? 

1. Will substances with any of the following properties be used during instruction: flammability, toxicity, corrosivity, reactivity, registered pesticide, legally controlled, or other characteristics with the potential to cause harm or injury? 
   Yes / No
   No

2. Will any physical hazards be present during instruction? (e.g., machines that need safety guards; razor blades or syringes; compressed gases, etc.). 
   Yes / No
   No

3. Will any biological hazards be present during instruction? (e.g., handling animals (rabies or hantavirus); cultures or stocks of infectious agents (fungal spores, viruses, bacteria, etc.). 
   Yes / No
   No

4. Will any radiation hazards be present during instruction? (e.g., radioisotopes, X-rays, ultraviolet rays, lasers, etc.). 
   Yes / No
   No

5. Will any electrical equipment that, due to its design, location, or method of use, pose any threat to safety during instruction? (Give considerable thought to electrical use outdoors, or any potentially wet location.). 
   Yes / No
   Yes

6. Will there be any personal safety issues related to the class? (e.g., due to time of day or location, at the end of any organized class exercise, will students be in danger of physical assault, etc.). 
   Yes / No
   No

7. Will any students be driving official state or research sponsored land or water vehicles during any class or instructional exercise? 
   Yes / No
   No

8. Will any type of personal protective equipment be necessary during class exercises? (e.g., hard-hats, eye/face protection, hearing protection, hand/foot protection, lab coat, visibility clothing, etc.) 
   Yes / No
   No

If the answer was “Yes” to any of the HEALTH AND SAFETY questions, please explain:

Several laboratory experiments require electrical equipment (pumps and pressure transducers) operated in a wet environment. The pumps are constructed by an external vendor and are designed to be operated in a wet environment. All plugs are equipped with a GFCI.

A detailed course description must accompany the Course Proposal Form
DETAILED COURSE DESCRIPTION

COURSE: ERE 339 – Fluid Mechanics
4 Credit Hours – Fall Semester
3 Hours of Lecture Per Week
1 Laboratory Session Per Week
Prerequisite(s): APM206 & GNE172

SCOPE:

1. Level of Instruction:
   a. ERE 339 is a required upper division course in the ERE curriculum
2. Relation to curriculum or to other ESF or Syracuse University courses:
   a. ERE 339 is a required course in the ERE curriculum. This course is open to all disciplines at ESF and SU if space allows.
   b. Shared resource requirements: a graduate class may be offered in the future depending on demand

STUDENT LEARNING OUTCOMES:

After completing this course students should be able:

1. To apply fundamental math and science concepts to problems involving fluids
2. To describe simple physical systems using mathematical expressions
3. To formulate and solve engineering design problems
4. To understand the theory and practice of making measurements of basic fluid phenomena
5. To design and conduct experiments to reveal fundamental behaviors of fluid systems
6. To use written and verbal communication skills to explain technical material as related to fluid phenomena
7. To recognize and qualitatively explain fluid mechanics concepts observable in everyday life

MAJOR CONCEPTS OR METHODOLOGIES:

This course is primarily intended to introduce fluid mechanics within the context of civil and environmental engineering. However, it also covers fundamentals applicable to any branch of fluid mechanics as well as topics that provide perspective on the relevance of fluid mechanics to systems outside the realm of civil and environmental engineering.

Foundational Material: Viscosity, kinematic viscosity, surface tension, hydrophobicity, unit conversions, laminar vs. turbulent flow, super critical vs. subcritical flow, steady vs. unsteady flow, uniform vs. varied flow, velocity fields, total derivative, streamlines, boundary layers.

Derivation and Application of Fundamentals: hydrostatics, Bernoulli’s Equation, energy equation, momentum equation, conservation of mass, dynamic similitude.

Engineering Design: Use of hydrostatics to design dams and gates. Application of the energy equation to design pipelines. Application of Manning’s Equation to design open channels. Use of pump characteristic curves to select pumps. Application of Darcy’s Law to predict subsurface flow rates.


Besides this specific content, the course is also intended to sharpen student’s quantitative skills. Namely, the class impels students to translate observable physical phenomena into a mathematical form. To this
end, the lab sessions are primarily intended to be an opportunity to observe fluid behavior first-hand and to try to quantitatively describe the behavior. Lab sessions include observation of viscosity, surface tension, outflow from an orifice, momentum exchange, energy losses in pipe flow, hydraulic jump, and porous media flow.

**CATALOG DESCRIPTION**  (Please provide using the precise format to be included in the ESF catalog, please do not exceed 1000 characters)

ERE 339. Fluid Mechanics  (4)

Three hours of lecture per week plus one lab session. An introduction to fluid mechanics within the context of civil and environmental engineering. This includes hydrostatics, Bernoulli’s Equation, control volume analysis, drag, dynamic similitude, pipe flow, and open channel flow with some brief coverage of hydraulic machines and flow in porous media. Fall.

Prerequisite(s): APM206 & GNE172 or equivalents

**COURSE HISTORY:**

This course was initially taught at ESF in the Fall of 2011. Students previously took a fluid mechanics course at Syracuse University (Fluid Mechanics for Engineers MAE 341), a class more oriented to mechanical and aerospace engineers. A fluid mechanics course is taught in Paper Science & Engineering (Fluid Mechanics PSE 371), but that course is more oriented to chemical engineering than civil and environmental engineering.

Last approved: never.

Revised Draft: November 10, 2009 (form in protected format: 3/21/12)