BEE 311 Ecological Fluid Mechanics
4 Credit Hours
Fall 2017

Lead Instructor: Chad Higgins
Hours: TR 8:00-9:50 Room: Gilmore 234
Telephone: 541-737-2286
Office hours: Wednesdays 11:00-12:00 or by appointment
Email: chad.higgins@oregonstate.edu

Catalog Description: Fluid properties, fluid statics, fluid motion, conservation of mass, momentum and energy for incompressible fluids, dimensional analysis, ecological engineering applications.

Prerequisites: Consent of instructor

Required Text: Elger Williams Crowe and Robertson, Engineering Fluid Mechanics, 10th Edition

Recommended Reading: None

References: None

Measurement and Evaluation of Student Performance:
Students will be assessed through a midterm examination, a final examination and weekly problem sets. Homework assignments will be given on Thursday each week, due the following Thursday at the beginning of class. Late homework will not be accepted. Homework will be graded collectively, in section.

Grading breakdown:
• Midterm Exam: 30%
• Final Exam: 40%
• Weekly Problem Sets: 30%

Learning Objectives:
Goals for the course include:

1. Analysis of fundamental concepts and governing equations for fluid flow applied to biological organisms and ecological systems.
2. Develop conceptualization and analytical skills to conduct analysis of ecological systems.
3. Develop skills to conduct rigorous engineering analysis and present results in a clear and concise manner.
ABET Program Learning Objectives met by BEE 311:

C. Ability to Design System to Meet Desired Needs  
K. Ability to Understand Techniques, Skills, and Modern Engineering Tools for Engineering Practice 
L. Ability to Apply Knowledge in Specialized Area Related to Ecological Engineering

Schedule:

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| **Week 1** | Intro, definitions, history and significance  
Fluid properties, units of measure  
Statics I: pressure forces on flat plates |
| **Week 2** | Statics II: forces on curves, buoyancy  
Statics III: Ecological Engineering applications  
Velocity and acceleration, Euler’s equation |
| **Week 3** | Bernoulli’s equation and its application  
rotation and vorticity  
Control volume approach, flow rates and the conservation of mass |
| **Week 4** | Continuity derivation and applications  
The Momentum equation  
Ecological Applications of the momentum equation |
| **Week 5** | Moment of momentum and the sprinkler  
Energy Principle |
| **Week 6** | Midterm exam (October 26th 2017)  
Combined use of energy, mass and momentum equations  
Concepts of Hydraulic and energy grade lines  
Dimensional analysis and the Buckingham Pi theorem |
| **Week 7** | Common Dimensionless numbers and Similitude  
Ecological Applications of Dimensional analysis  
Surface resistance, shear, and the boundary layer |
| **Week 8** | Applications to the atmospheric boundary layer  
Flow in pipes laminar and turbulent  
Energy losses in pipes |
| **Week 9** | The moody Diagram  
Drag, flow around objects  
Flow through pant canopies |
| **Week 10** | Flow in open channels  
Manning’s equation  
Hydraulic Jumps |

Late homework will not be accepted.
**Students with Disabilities:**

“Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at http://ds.oregonstate.edu. DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.”

**Academic Dishonesty and Student Conduct:**

The Biological & Ecological Engineering Department follows the university rules on civility and honesty. These can be found at:


At Oregon State University academic dishonesty is defined by the Oregon Administrative Rules 576-015-0020.1.a-c as: An intentional act of deception in which a student seeks to claim credit for the work or effort of another person or uses unauthorized materials or fabricated information in any academic work. Academic dishonesty includes:

- **CHEATING** – Use or attempted use of unauthorized materials, information or study aids or an act of deceit by which a student attempts to misrepresent mastery of academic interest or information. This includes unauthorized copying or collaboration on a test or assignment or using prohibited materials and texts.

- **FABRICATION** – falsification or invention of any information (including falsifying research, inventing or exaggerating data and listing incorrect or fictitious references.

- **ASSISTING** – Helping another commit an act of academic dishonesty. This includes paying or bribing someone to acquire a test or an assignment, changing someone’s grades or academic records, or taking a test/doing an assignment for someone else (or allowing someone to do these things for you). It is a violation of Oregon state law to create and offer to sell part or all of an education assignment to another person (ORS 165.114).

- **TAMPERING** – altering or interfering with evaluation instruments and documents.

- **PLAGIARISM** – representing the word or ideas of another person as one’s own OR presenting someone else’s words, ideas, artistry or data as one’s own. This includes copying another person’s work (including unpublished material) without appropriate referencing, presenting someone else’s opinions and theories as one’s own, or working jointly on a project, then submitting it as one’s own.