**Engineering School of Sustainable Infrastructure & Environment**
**CWR 6240 - Mixing and Transport in Turbulent Flow**
Credit 3 – Spring 2019

**Prerequisite**: ENG 3353 (or CWR 3201), MAP 2301

**Lectures**: MWF 5th period, Room 273 Weil Hall

**Instructor**: Dr. Xiao Yu
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**Description**: The objective of this course is to apply fluid mechanics to problems of turbulent mixing and transport of substances in the natural environment with emphasis on engineering methods:

- Fundamentals of turbulence
- Understand the effects of diffusion, advection and dispersion of substances in the environment
- Evaluate the important processes affecting fate and transport in a range of problem situations
- Engineering approaches to study flow turbulence in natural environments, applications to turbulent shear flows, channel flows, boundary layers and buoyant plumes
- Introduction to simple turbulence closure and more complex closure schemes, including the two equation models and Large Eddy Simulation models

**Outline of the topic covered in the class**

- Review of fundamental laws and constitutive equations
- Concept of turbulence
- Introduction to turbulent boundary layers
- Introduction to turbulent models
- Dispersion and mixing in rivers, estuary and oceans.

**CFD Lab**
A CFD Lab will be offered this semester. OpenFOAM will be used since most widely-used turbulent models were already implemented. Lectures on how to use UF cluster HiPerGator and OpenFOAM will be given as short courses during the semester.

**Grading**
Your final grade for the course will be evaluated as follow

- Homework: 40%
- Midterm/Final exams: 15% each
- Final project: 30%

Midterm and final exams will be in class closed book quizzes. The grading of the exam will be based on both the approach and the final answer. Final project will be **paper presentation and a group project**. For paper presentation, each student will select a paper in the topic of turbulent

research. You need to **confirm with the instructor about the selected paper**. Each talk will occupy **15 minutes**, followed by **5 minutes** for questions, comments and transition. For group project, each group will be assigned a project related to your research interest, the topic will be determined after the midterm.

Final letter grades will be assigned based on the following scale

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| A | 100-90% |
| B | 89-80% |
| C | 79-70% |
| D | 69-60% |
| F | 59-0% |

**Accommodations for Students with Disabilities:** Students requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the instructor when requesting accommodation.

**Textbooks**

There is no required textbook for this course. The following book is recommended:

- Fischer, H. B., List, E. J., Koh, R. C. Y., Imberger, J. and Brooks, N. H. (1979). Mixing in inland and coastal waters. Academic Press: San Diego, California.
- Tennekes, H. and Lumley, J. L. (1972). A first course in turbulence (1st Edition). The MIT Press.
- Pope, S. B. (2000). Turbulent Flows. Cambridge University Press.
- Schlichting, H. and Gersten, K. (2000). Boundary layer theory (8th Edition). Springer.