ENGR 120 Fluid Mechanics

Scope: This course will introduce engineers to the mechanics of fluids in natural and engineered systems. Upon successful completion of this course, students will be able to analyze internal and external flows as well as perform design of flow systems.

When: Tuesday & Thursday 9 am - 10:15 am (Lecture); total of 6 lab sessions available (please refer to the registrar's website for exact timings). Students will attend lab sessions as registered for originally during online registration. If there is an emergency that prevents the student from attending his/her registered lab session, the student may be permitted to attend a different lab session after prior approval from instructor and teaching assistants.

Where: SSB 160 (Lecture); SE2 150 (Lab)

Instructor: Prof. Venkattraman Ayyaswamy (Pronounced When-cut-ra-mun I-ya-swa-me)

Office Hours: Tuesday & Thursday 2:30 - 3:30 pm; **Office**: SE2 278

Email: vayyaswamy@ucmerced.edu; **Phone**: (209) 228 2359

Teaching Assistant 1: Ms. Shadi Zaheri Sarabi

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Office Hours: Wednesday 1:00 - 2:00 pm (location to be announced)

Teaching Assistant 2: Mr. Abhishek Kumar Verma

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Office Hours: TBA

Books (required)

1. Frank M. White, "Fluid Mechanics", *8th edition*, 2016. *Note that only Chapters 1-7 are relevant to this course. If you want to save money, there is also an international edition that you can buy online. The international edition will have the same content but is black/white.*

Course Outline

- **Introduction**: Concept of a fluid; fluid as a continuum; thermodynamic properties of a fluid; viscosity; streamlines, streaklines and pathlines
- **Pressure and related concepts**: Equilibrium of a fluid element; hydrostatic pressure distributions; manometry; buoyancy and stability; pressure measurement.
- **Integral relations**: Basic physical laws; conservation of mass, momentum and energy equation; Bernoulli's equation; angular momentum conservation.
- **Differential relations**: Differential equations for conservation of mass, momentum and energy; boundary conditions; concept of streamfunction; vorticity and irrotationality.
- **Dimensional Analysis and Similarity**: Buckingham's π theorem; non-dimensionalization; modeling and similarity
- **Viscous flows in ducts**: Reynolds number regimes; internal versus external viscous flows; Head loss - the friction factor; laminar fully-developed pipe flow; flow -n non-circular ducts; losses in pipe systems; multiple-pipe systems
- **Flow past immersed bodies**: Reynolds number and geometry effects; momentum integral estimates; boundary layer equations; flat plate boundary layer; boundary layers with pressure gradient.

Academic Dishonesty Statement

- Each student in this course is expected to abide by the University of California, Merced's Academic Honesty Policy. Any work submitted by a student in this course for academic credit will be the student's own work.

- You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an e mail, an e mail attachment file, a diskette, or a hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment. Penalty for violation of this Policy can also be extended to include failure of the course and University disciplinary action.
- During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.

Disability Statement: Accommodations for Students with Disabilities: The University of California Merced is committed to ensuring equal academic opportunities and inclusion for students with disabilities based on the principles of independent living, accessible universal design and diversity. I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances. Students are encouraged to register with Disability Services Center to verify their eligibility for appropriate accommodations.

Lab Schedule

Week	Lab Activity
01/23/2017	No Lab
01/30/2017	Lab 1: Basic experimental error propagation
02/06/2017	No Lab
02/13/2017	Lab 2: Buoyancy force concepts
02/20/2017	No Lab
02/27/2017	Lab 3: Introduction to wind tunnel and pitot tube measurements
03/06/2017	No Lab
03/13/2017	Lab 4: Measurements of flow past a cylinder
03/20/2017	No Lab
03/27/2017	No Lab
04/03/2017	Lab 5: Non-invasive flow measurements: Vibrations and pipe flow
04/10/2017	No Lab
04/17/2017	Lab 6: Characterization and design of a siphon weir
04/24/2017	No Lab
05/01/2017	No Lab

Grading

- Homeworks: 30%
- Mid-term Exams: 30%
- Final Exam: 25%
- Lab reports: 15%

Homeworks are typically assigned on Thursday (check CatCourses) and will be due (in class) on the date indicated (typically after one week). Late homeworks will be accepted till the following day (basically a 24-hour extension) but for a reduced credit of 75%. To reiterate, feel

free to discuss among yourselves to complete the homework problems, but reproducing another person's work is not acceptable. Details of exams will be provided as the course progresses. The final exam will be comprehensive but with a higher weightage for topics covered in the second half. Lab reports will be due the next time you come to lab. For Lab 6, the lab report will be due in 14 days from the day the experiment was performed. For example, if you did Lab 6 on 04/17/2017, the report will be due on 05/01/2017. Even though you work as a group in the lab, individual lab reports must be submitted. The tentative schedule of labs is provided in the table above. Students registered for a particular lab session will be divided into groups of five based on the alphabetical order of last names. You will also be assigned a group number (1 to 4). While some experiments have enough equipment for all groups to perform the experiment at the same time, other experiments will require certain groups to wait till other groups complete. Specific instructions will be provided by the TAs during the lab session. Note that attendance in labs is mandatory and will be assigned 25 points.

The instructor reserves the right to change the grading policy and syllabus depending on the overall course progress but any change will be communicated in advance to the students.