Rensselaer Polytechnic Institute

Department of Mechanical, Aerospace & Nuclear Engineering

MANE-6520-01 - Fluid Mechanics

Fall Semester 2019

Course Syllabus

Course Information

INDEPENDENT STUDY IN MANE		MANE 6520	Section 01
RPI Fall 2019	3 cr		
Lecture	M, Th	Noon-1:20PM	LOW 3045

Prerequisites or Other Requirements:
Pre-requisites: Undergraduate multivariate calculus and undergraduate fluid mechanics.

Instructor

Professor Zvi Rusak*	rusakz@rpi.edu
Office Location: JEC 4010	(518) 276-3036
Office Hours: M 4:00PM-5:00PM Th 4:00PM-5:00PM	

***Fellow, American Physical Society**

***Fellow, American Society of Mechanical Engineers**

***Associate Fellow, American Institute of Aeronautics & Astronautics**

Teaching Assistant(s)

Name	Office	Office Hours	Email Address
Cal Manjunath	JEC 1218	Wednesdays 4-6PM	manjuk@rpi.edu

Course Text(s)

Optional: R.L. Panton, Incompressible Flow, Fourth edition, Wiley (2013).

Reference Books

G.K. Batchelor, An Introduction to Fluid Dynamics, Cambridge University.
F.M. White, Viscous Fluid Flow, 3rd edition, McGraw-Hill Higher Education, 2006.
Van Dyke, M. An Album of Fluid Motion, Parabolic press

Course Goals / Objectives

A thorough understanding of the basic fundamentals of fluid mechanics of incompressible flows. Knowledge of the solution of fundamental problems in fluid mechanics and the underlying physical interpretation. Tools to solve simple problems in fluid mechanics. Some knowledge of turbulence and turbulent flows.

Course Content

Topics: Continuum hypothesis; Perfect gas and departures from perfect gas; Vector and Tenors; Conservation laws for a continuum: mass, momentum and energy; Constitutive theory for fluids; Viscosity and molecular transport; Compressible Navier Stokes equations; Kinematics of the flow field: vorticity, streamlines; Incompressible Navier Stokes equations and their applications: Poiseuille flow, low Reynolds number flows, flows at high Reynolds number, boundary layers, external flows; Turbulence; introduction to the theory of turbulence;

Student Learning Outcomes

1. Students should understand basic conservation laws of Fluid Mechanics.
2. Students should understand the kinematics of fluid motion.
3. Students should understand the concept of a Newtonian fluid and viscosity.
4. Students should be comfortable with the Navier-Stokes Equations.
5. Students should be able to formulate and solve simple incompressible viscous flow problems.
6. Students should understand the concept of irrotational flows, and be able to use the potential theory of fluid mechanics.
7. Students should be able to understand the concept of streamlines, stream function and vorticity.
8. Students should be familiar with boundary layer flows.
9. Students should understand the basis of analyzing the stability of flows.
10. Students should have an understanding of turbulent flows.

Course Assessment Measures

Assessment	Due Date	Learning Outcome #s
Homework	once every two weeks	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
Exam 1 (closed notes & books)	10.22.2019	1, 2, 3, 4, 5
Exam 2 (closed notes & books)	12.09.2019	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
Semester Project	12.11.2019	6, 7, 8, 9, 10

Grading Criteria

Problem sets: 10%
Project : 20%
Exam 1 : 35%
Exam 2 : 35%

Class Policies:

Student-teacher relationships are built on trust. For example, students Must trust that teachers made appropriate decisions about the structure and content of the courses they teach, and teachers must trust that the assignments the students that students turn in are their own. Acts which violate this trust undermine the educational process. The *Rensselaer Handbook of Student Rights and Responsibilities* defines various forms of Academic Dishonesty and you should make yourself familiar with these. In this class, all assignments that are turned in for grade must represent the Student's own work. In cases where help was received, or teamwork was allowed, a notation on the assignment should indicate your collaboration. **Submission of any assignment that is in violation of this policy will result in the penalty of a grade of zero for this assignment.** If you have any questions concerning this policy before submitting an Assignment, please ask the professor for clarification.

All students are expected to be familiar with and abide by the policies and procedures, including those on academic integrity, contained in the current version of the *Rensselaer Handbook of Student Rights and Responsibilities.* Any individual assignments you submit in this course should be entirely your own work. Copying homework or projects will not be tolerated. I would, through encourage you to first do your assignments by yourself and then discuss them with your classmates.

Cheating or plagiarism will result in punitive measures.

Attendance is not required. You will, of course, be responsible for all material covered and assignments made in the lectures. Also, I would ask that, out of courtesy to both your fellow students and myself, you make every attempt to arrive to class on time and conduct yourself professionally in the classroom.

Remarks:

The homework you submit is expected to consist of your own work although discussions with your classmates and/or instructor are encouraged (Please use the office hours).

All exams will be considered using the honor system. Please refer to your Student Handbook for specific University policies and expectations.

Homework assignments and class notes will be sent by email.

Homework will be graded on 0-to-10 scale.

Performance at and above 94% will be rated A.

Performance below 55% will be rated F.

Assessment of your progress in terms of relative position in top 25%, 50% and 75% of class will be given upon request in the middle of the semester.

Absences from exams are to be negotiated in advance, unless a documented excuse is provided.

Any single poor performance will be considered on an individual basis. Please come to discuss this with me at the earliest possible.

Special days:

September 2, 2019 Labor day, No class
September 3, 2019 is a **Monday schedule**
September 5, 2019 **No class**
September 13, 2019 Last day to Add/Change/Audit course
October 14, 2019 **No Class**, Columbus Day
October 25, 2019 Last day to Drop a course
November 25, 2019 No class, annual meeting of the APS-DFD
November 27- 30 Thanks Giving, **No class**
December 11, 2019 Last day of classes
December 12-15, 2019 Reading days
December 16-20, 2019 Finals week