Fall 2019

ME 304-003: Fluid Mechanics

Samaneh Farokhirad

Course Syllabus and Guidelines [Fall 2019]
ME 304-003 - Fluid Mechanics
Monday & Thursday 4:00 PM - 5:20 PM
Kupfrain Hall, Room 209

Prof. Samaneh Farokhirad
Email: samaneh.farokhirad@njit.edu
Office Location: Department of Mechanical Eng. – Room ME329
Office Hours: Walk-in: Thursday 1pm-2pm
Other times: by prior appointment
Office Phone: (973) 596-3350

It is the responsibility of the student to read and understand this course syllabus. This syllabus is subject to change and may be updated throughout the semester.

Course Description: Fundamental concepts; fluid statics; fluid dynamics; steady and unsteady Bernoulli's equation; control volume analysis; basic flow equations of conservation of mass, momentum, and energy in fixed and moving control volumes; differential analysis of fluid flow; dimensional analysis and similitude; laminar and turbulent flow; lift and drag; boundary layers.

Credit Hours: 3
Prerequisite: Dynamics II, MECH 236; Thermodynamics, ME 311
Lecture: 2 days per week at 80 minutes

Textbook: Fundamentals of Fluid Mechanics, 8th Edition
Author(s): Munson, Young, and Okiishhi's
Amazon URL: tinyurl.com/me304003
AbeBooks URL: tinyurl.com/me304003abe

Course Outcomes:
At the completion of this course, students will be able to:

1. Identify or predict the flow regime in a given engineering system based on consideration of the governing non-dimensional groups
2. Calculate the hydrostatic forces and moments on planar and curved submerged and floating surfaces
3. Construct an appropriate (fixed, deforming, or moving) control volume for a given engineering system and apply the principles of conservation of mass, momentum, and energy to this control volume
4. Decide when appropriate to use ideal flow concepts and the Bernoulli's equation
5. Present data or governing equations in non-dimensional form, design experiments, and perform model studies

6. Solve for internal flow in pipes and channels through simple solutions of the Navier-Stokes equations, the Moody chart, or the head-loss equation
7. Solve for external flow, evaluate lift and drag, know when there is possibility of flow separation, apply streamlining concepts for drag reduction by using experimental correlations

Course Topics:

The following topics will be covered in this course:

1. Fluid properties, fluid forces, and flow regimes.
2. Fluid statics.
3. Flow kinematics.
4. Conservation of mass, momentum, and energy in fixed, deforming, and moving control volumes.
5. The steady and unsteady Bernoulli's equation along and normal to a streamline.
6. Similitude, dimensional analysis, and modeling; important non-dimensional groups in fluid mechanics.
7. Conservation of mass and momentum expressed through differential analysis.
8. Viscous flow in pipes (laminar and turbulent flow regimes, the Moody chart, head-loss equation).
9. External flow boundary layer concept, lift and drag, pressure and friction drag, streamlining and drag reduction.

Course Policies:

- Assignments
  - Homework assignments will be collected ONLY from students who are present on the date that the assignments are collected.
  - Homework will be assigned weekly and is due a week later before class.
  - Completed assignments should be turned in at the beginning of class on the due date.
  - No late homework assignment

- Exams
  - There will be two exams during the semester and a final exam.
  - The final exam will be a common exam, the time and place announced by the registrar's office. For conflicts, we follow the NJIT policy for final exams provided online. The policy generally indicates that the course with the higher numerical value takes place during the regularly scheduled period. [1]
  - Only non-programmable calculators are allowed during exams. *Mobile phones, smart watches, programmable calculators, and similar electronic devices are expected to remain out of sight — the sight of a mobile phone, smart watch, or programmable calculator* during an exam results in a grade of **F** for the class.

- The exam materials consist of two documents, a question booklet, and an answer sheet. Please note the answer sheet is the only thing that will determine the grade, not what is in the exam booklet.
- Failure to show for an exam results in a grade of zero, unless the dean of students contacts the instructor, and a decision is made otherwise. Employment is not considered a valid reason for missing an exam, and no makeup exams will be given.

- Attendance and Absences
  - Attendance is expected and will be taken each session.
  - Students are responsible for all missed work, regardless of the reason for absence.
  - In the case that a student is absent (or expects to be absent) for an exam, the following actions are required in order for that exam grade to be non-zero:

1. The student should write an email to the professor indicating that he/she is going to contact the dean of students office about their absence from the exam. Those expecting official travel (i.e., athletes, academic conferences, etc.) must notify the professor and the dean of students office at least 2 weeks prior to the exam. In extreme cases (i.e., unforeseen sickness, death, etc.) the student must notify the professor and dean of students office within 48 hours after the originally scheduled exam time. In the email sent to the dean of students office, students should at a minimum include the following: (i) name; (ii) ID number; (iii) course and section; (iv) professor's name and email; (v) regularly scheduled exam time; (vi) evidence for absence.
2. Upon receiving notice from the dean of students office, the professor will contact the course coordinator and provide the relevant information.
3. Since it is likely that multiple students across different sections are in a similar situation, the course coordinator will make a decision that is equitable to everyone involved.

Grade Distribution:

The weights shown in the table will be used in the determination of the final course grade.

Quiz:	10%
Homework:	10%
Classroom Participation:	5%
First Exam:	25%
Second Exam:	25%
Third Exam:	25%

Note: Any disagreement over grades must be brought to the attention of the instructor no later than the deadline specified by the instructor. Further, final grades are typically not discussed via email, an appointment should be made.

Academic integrity

Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found here.

Please note that it is the professional obligation and responsibility of faculty to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing, using any online software inappropriately, or other forms of dishonesty in academics will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu.

Approximate Outline: A lecture period is 100 minutes.

Lecture	Topic	Reading
1-2	Introduction and Fundamentals	**Ch.1**: 1.1-1.10
3-5	Fluid Statics	**Ch.2**: 2.1-2.11.1
6-8	Fluid Dynamics	**Ch.3**: 3-1-3.8
9-10	Fluid Kinematics	**Ch.4**: 4.1-4.4
11	Review (1 lecture period)	**Ch.1 – Ch.4**
12	1st Midterm (1 lecture period)	**Ch.1 – Ch.4**
13-16	Control Volume Analysis	**Ch.5**: 5.1-5.3
17-18	Differential Analysis	**Ch.6**: 6.1-6.3, 6.8-6.9
19-20	Dimensional Analysis and Modeling	**Ch.7**: 7.1-7.9
21	Review (1 lecture period)	**Ch.5 – Ch.7**
22	2nd Midterm (1 lecture period), there is indeed some overlap	**Ch.5 – Ch.7**
23-25	Viscous Flow in Pipes	**Ch.8**: 8.1-8.5.1
26-28	External Flow and Boundary Layer Concept	**Ch.9**: 9.1-9.3
Final	Comprehensive but emphasizes **topics 5-9**	**Ch.1 – Ch.9**

[1] This paragraph does not apply to summer courses, where exam details are handled in each class.