New Jersey Institute of Technology
School of Applied Engineering & Technology
MET 304 Applied Fluid Mechanics

COURSE NUMBER	MET 304
COURSE NAME	Applied Fluid Mechanics
COURSE STRUCTURE	(2-2-3) (lecture hr/wk - lab hr/wk – course credits)
COURSE COORDINATOR/ INSTRUCTOR	Dr. J. Sodhi/Dr. S. Rahman
COURSE DESCRIPTION	An introduction to fluid statics and the basic laws of fluid flow; conservation of mass, momentum and energy. Applications of the basic laws to internal and external incompressible flow, including specific topics in pipe flow systems, centrifugal pumps and fans, streamlining, and fluid flow meters.
PREREQUISITE(S)	MATH 238 or MATH 112, PHYS 103 or PHYS 121
COREQUISITE(S)	None.
REQUIRED, ELECTIVE OR SELECTED ELECTIVE	Required.
REQUIRED MATERIALS	TEXT: **A Brief Introduction to Fluid Mechanics – 6th Edition,** by Young, Munson & Okiishi – John Wiley & Sons, Inc. [IBSN: 9781119611714, 9781119611172 (E-book)]
COMPUTER USAGE	Word, Excel – Lab reports
COURSE OUTCOMES (CO)	By the end of the course students should be able to: 1. Apply Pascal's law to lift large weight by a small force. 2. Determine hydrostatic force on a submerged plane surface, buoyant force on floating and submerged bodies, density of liquid and solid by using the concept of buoyant force. 3. Generate an analytical expression for the flow streamlines if two-dimensional velocity field is given. 4. Determine power generation potential and efficiency of a hydraulic turbines, pumps, turbine-generator and pump-motor combinations. 5. Apply Bernoulli Equation and Pitot formula to calculate flow velocity. 6. Determine anchoring force on a pipe by using linear momentum equation. 7. Apply Buckingham Pi Theorem to develop the functional relationship between parameters in fluid mechanics problems. 8. Measure flow rates in pipes by using obstruction flow meters:

Orifice, Venturi and Nozzle.
9. Determine the drag and lift force on a streamlined body or a blunt/bluff body moving in a fluid.
10. Apply Manning equation to calculate open channel flow.
11. Conduct laboratory experiments, analyze data and present results.
12. Write effective laboratory reports according to acceptable criteria.

CLASS TOPICS

Introduction/Fluid Properties/Pressure, Hydrostatic Forces, Buoyancy, Classification of Flows, Conservation of Mass, Energy, and Momentum, Centrifugal Pumps, Dimensional Analysis and Similitude, Flow Over Immersed Bodies, Drag and Lift Forces, Flow in Pipes/Non-Circular Conduits, Open Channel Flow. Lab Experiments: Lab E1 - Flow Measurement Methods, Lab E2 - Centrifugal Pump Performance, Lab E3 - Drag & Lift Characteristics of an Airfoil, Lab E4 - Drag and Pressure Distribution on a Cylinder

STUDENT OUTCOMES

The Course Outcomes support the achievement of the following MET Student Outcomes:

Student Outcome (1) - an ability to apply knowledge, techniques, skills, and modern tools of mathematics, science, engineering, and technology to solve broadly-defined engineering problems appropriate to the discipline
Related CO – 4, 6, 11, 12

Student outcome (3) - an ability to apply written, oral, and graphical communication in broadly-defined technical and non-technical environments: and an ability to identify and use appropriate technical literature
Related CO – 12

Student outcome (4) - an ability to conduct standard tests, measurements and experiments and to analyze and interpret the results to improve processes
Related CO – 11

Student outcome (5) - an ability to function effectively as a member as well as a leader on technical teams
Related CLO – 11, 12

GRADING POLICY

Homework	15 %
Lab reports	30%
Tests (2x15%)	30 %

Final Exam 25 %

Note: You may not pass the course if you are having failing grades (<50%) on the midterm tests and the final exam. There are two midterm tests and one final exam during the semester. Make-up exams are given only in some special cases approved by the Dean of Students.

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 at: NJIT Academic Integrity Code.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately 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."

GENERATIVE AI

Student use of artificial intelligence (AI) is permitted in this course for certain assignments and activities. It is not permitted to be used in the assignments noted by the instructor, as doing so would undermine student learning and achievement of course learning outcomes. Additionally, if and when students use AI in this course, the AI must be cited as is shown within the NJIT Library AI citation page for AI. If you have any questions or concerns about AI technology use in this class, please reach out to your instructor prior to submitting any assignments.

STUDENT BEHAVIOR

- No eating or drinking is allowed at the lectures, recitations, workshops, and laboratories.
- Cellular phones must be turned off during the class hours – if you are expecting an emergency call, leave it on vibrate.
- No headphones can be worn in class.
- Unless the professor allows the use during lecture, laptops should be closed during lecture.
- During laboratory, if you are finished earlier, you must show the professor your work before you leave class
- Class time should be participative. You should try to be part of a discussion

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MODIFICATION TO COURSE	The Course Outline may be modified at the discretion of the instructor or in the event of extenuating circumstances. Students will be notified in class of any changes to the Course outline.
PREPARED BY	Dr. S. Rahman / Dr. J. Sodhi
COURSE COORDINATED BY	Dr. J. Sodhi

CLASS HOURS

Thursday 06:00 PM – 10:00 PM KUPF 210 & ME 110

OFFICE HOURS

by appointment contact in advance: **(973) 596-6072** or **rahman@njit.edu**

HOMEWORK - IMPORTANT

Homework is usually **due the week following the date they are assigned, and must be submitted to the instructor.**

LABORATORY:

The laboratory experiments will be performed in Room 110-MEC. When an experiment is not scheduled, a lecture on the laboratory experiments or a problem session will be scheduled.

Experiment E1 - Flow Mesurement Methods
Experiment E2 - Centrifugal Pump Performance
Experiment E3 - Drag & Lift Characteristics of an Airfoil
Experiment E4 - Drag and Pressure Distribution on a Cylinder

Laboratory Reports (30% of final grade)

1. All laboratory reports must be written on a word processor. Equations, calculations, graphs and figures must also be performed via appropriate software, e.g., MathCAD, AutoCAD, etc. Only rough sketches can be done freehand, but must be neat.

2. EXPERIMENTS E1, E2, E3 and E4 (30% of final grade)
   a. The written report for each of these experiments is due about 2 weeks after the experiment is completed. Late reports will be penalized 0.5 points per week out of a possible 10 total points.
   b. The written reports are to be concise (approximately 15/20 pages) and consist of the following:

      LAB REPORTS (will be discussed more in detail)

      i. Abstruct, Theory, Summary of Procedure and Sample Calculations (35% of report grade)
      ii. Data Tables and Results (15% of report grade)

iii. **Graphs, Discussion of Results and conclusions (30% of report grade)**
iv. **Grammar, Spelling and overall appearance (20% of report grade)**

Each student must submit their own laboratory reports. A lab report submitted without lab attendance will not be accepted and without submitting lab reports you can't pass this course.

Grading Legend (tentative, may change depending on average final score)

GRADE	NUMERIC RANGE
A	90 to 100
B+	85 to 89
B	80 to 84
C+	75 to 79
C	70 to 74
D	60 to 69
F	0 to 59

NJIT ONLINE INFORMATION

If required, the instructor will discuss these requirements on the first day of the course and/or post on their Learning Management System (LMS). Please become familiar

- Canvas: https://canvas.njit.edu/
- Zoom: https://njit-edu.zoom.us/
- Online Proctoring: https://ist.njit.edu/online-course-exam-proctoring

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COURSE OUTLINE

WEEK	DATES	TOPICS	SECTIONS/ CHAPTERS	ASSIGNMENTS (will be posted on Canvas)
1	Jan 23	Introduction	Chapter 1	
2	Jan 30	Pressure/Hydrostatic Forces/Buoyancy	Chapter 2	
3	Feb 6	Elementary Fluid Dynamics – the Bernoulli Equation	Chapter 3	
4	Feb 13	Elementary Fluid Dynamics – the Bernoulli Equation	Chapter 3	
5	Feb 20	Lab E1 – Flow Measurement Methods		
6	**Feb 27**	Review (discussion) **Midterm Exam 1**	Chapters 1, 2 & 3 and Lab E1	
7	Mar 6	Turbomachinery – The Centrifugal Pump	Chapter 11	
8	Mar 13	Lab E2 - Centrifugal Pump Performance Fluid Kinematics		
9	Mar 27	Fluid Kinematics Flow Over Immersed Bodies, Drag and Lift Forces	Chapters 4 & 9	
10	Apr 10 (No Class on Apr 3 – Wellness Day)	Lab E3 - Drag and Pressure Distribution on a Cylinder		
11	**Apr 17**	Review (discussion) **Midterm Exam 2**	Chapters 4, 9 & 11 and Labs E2 & E3	
12	Apr 24	Lab E4 - Drag & Lift Characteristics of an Airfoil Dimensional Analysis, Similitude and Modeling	Chapter 7	
13	May 1	Finite Control Volume Analysis -- Conservation of Mass/Conservation of Energy/Conservation of Momentum	Chapter 5	
14	May 6 (Tuesday on Thursday schedule)	Open Channel Flow + Review	Chapter 10	
15	**TBD**	**FINAL EXAM (Cumulative)**		