

SYLLABUS & COURSE INFORMATION

MEC 364 – INTRODUCTION TO FLUID MECHANICS

FALL 2024

DESCRIPTION:

Fundamental properties of fluids and their conservation laws with applications to the design and evaluation of flows of engineering interest. Topics include hydrostatics, surface tension, dimensional analysis and dynamic similitude, Euler's equation, rotating coordinate systems, boundary layers, lubrication, drag on immersed bodies, open channel and pipe flows, and turbomachinery.

Prerequisites: PHY 126 or PHY 131; MEC 262; MEC Major

INSTRUCTOR: Spencer Zimmerman

Office Hours: Tuesday (11:00 AM – 12:30 PM) & Thursday (11:00 AM – 12:30 PM)

Location: 159 Light Engineering Building

E-mail: spencer.zimmerman@stonybrook.edu

TEACHING ASSISTANTS: Jason Loprete and Nikolas Arsenlis

Office Hours: Monday (11:00 – 12:30 PM) & Wednesday (11:00 – 12:30 PM)

Location: 158 Light Engineering Building

E-mail: jason.loprete@stonybrook.edu; nikolas.arsenlis@stonybrook.edu

WEEKLY SCHEDULE: **LECTURE** – Monday & Wednesday (5:00 – 6:20 PM)

Location: 102 Javits Lecture Center

RECITATION – Monday (R01) & Wednesday (R02) (9:30 – 10:25 AM)

Location: 137 Psychology A

TEXT: Fundamentals of Fluid Mechanics (Gerhart, Hochstein, Munson, Young and Okiishi)

with zyBooks access for reading and homework assignments.

1. Sign in or create an account at learn.zybooks.com
2. Enter zyBook code **STONYBROOKMEC364ZimmermanFall2024**
3. Subscribe

CREDIT EARNED: 3 credits

GRADING: Your semester letter grade will be based upon your performance in the following categories:

Homework – 15%

Exam I – 25%

Exam II – 25%

Final Exam – 35%

There will be no make-up exams unless arranged prior to the exam.

Each of the exams will be cumulative.

HOMEWORK: Homework problems will be assigned every week or two. A zyBooks registration code (see TEXT above) is required for online homework assignments. Late homework will not be accepted, except under documented emergencies.

COURSE LEARNING OBJECTIVES:

1. An ability to quantitatively represent fluid flow variables using dimensions and units.
2. An understanding of the concept of viscous flow, including pressure, viscosity, and surface and body forces.
3. An understanding of the principle of manometer as a measuring instrument and determining the hydrostatic force on submerged surfaces.
4. Applying mass conservation and the integral method to determine the force between fluid flow and surfaces of hydraulic machinery.
5. An ability to use velocity field representation to determine the incompressibility, irrotationality, and acceleration of a fluid flow.
6. An understanding of Navier-Stokes equations.
7. An ability to apply Bernoulli Theorem.
8. An understanding of the concept of boundary layers.

TENTATIVE WEEKLY SCHEDULE

	Lectures (Monday and Wednesday)	Recitations (Monday and Wednesday)
Week 1 Aug. 26 – 30	Chap. I Introduction	No recitation
Week 2 Sept. 2 – 6	M (Sept. 02): No Class (Labor Day) ...	Rec. 1: Ideal gas law and unit conversions HW#1 assigned
Week 3 Sept. 9 – 13	Chap. II Fluid Statics	Rec. 2: Streamlines and shear stress HW#1 due, HW#2 assigned
Week 4 Sept. 16 – 20	...	Rec. 3: Manometers HW#2 due, HW#3 assigned
Week 5 Sept. 23 – 27	Chap III Bernoulli Eq./Perfect fluids	Rec. 4: Submerged plates and curved surfaces HW#3 due, HW#4 assigned
Week 6 Sept. 30 – Oct. 4	Chap IV Fluid Kinematics	Rec. 5: Bernoulli Eq. HW#4 due, HW#5 assigned
Week 7 Oct. 7 – 11	M (Oct. 7) Exam I W Chap V Finite control volume analysis	Review of previous problems for Exam I HW#5 due
Week 8 Oct. 14 – 18	M (Oct. 14): No Class (Fall Break) ...	Rec. 6: Material derivative and mass conservation HW#6 assigned
Week 9 Oct. 21 – 25	...	Rec. 7: Momentum and energy Eqs. in integral form HW#6 due, HW#7 assigned
Week 10 Oct. 28 – Nov. 1	Chap VI Differential analysis	Rec. 8: Continuity Eq. and vorticity HW#7 due, HW#8 assigned
Week 11 Nov. 4 – Nov. 8	... W (Nov. 6) Exam II	Review of previous problems for Exam II HW#8 due
Week 12 Nov. 11 – 15	Chap. VII Dimensional Analysis and Similitude	Rec. 9: Navier Stokes Eq. HW#9 assigned
Week 13 Nov. 18 – 22	Chap. VIII Internal Flows: Viscous Flow in Pipes	Rec. 10: Dimensional analysis and model study HW#9 due, HW#10 assigned
Week 14 Nov. 25 – 29	M (Nov. 25) & W (Nov. 27): No class (Thanksgiving)	No recitation (Thanksgiving)
Week 15 Dec. 2 – Dec. 6	Chap. IX External Flows: Flows over Immersed Bodies	Review of all previous problems HW# 10 due
Week 16 Dec. 9	M (Dec. 9): General review	No recitation (Class end)
Final Week	Final Exam (Based on all material)	

ALLOWED CALCULATORS:

- **Casio:** All **fx-115** models. Any Casio calculator must contain **fx-115** in its model name.
- **Hewlett Packard:** The **HP 33s** and **HP 35s** models, but no others.
- **Texas Instruments:** All **TI-30X** and **TI-36X** models. Any Texas Instruments calculator must contain either **TI-30X** or **TI-36X** in its model name.

STONY BROOK UNIVERSITY SYLLABUS STATEMENT:

Student Accessibility Support Center Statement

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, Stony Brook Union Suite 107, (631) 632-6748, or at sasc@stonybrook.edu. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and the Student Accessibility Support Center. For procedures and information go to the following website

<https://ehs.stonybrook.edu/programs/fire-safety/emergency-evacuation/evacuation-guide-disabilities> and search Fire Safety and Evacuation and Disabilities.

Academic Integrity Statement

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at http://www.stonybrook.edu/commcms/academic_integrity/index.html

Critical Incident Management

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Student Conduct and Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.

Equivalent Opportunity/Religious Absences:

Some students may be unable to attend classes on certain days because of religious beliefs. Section 224-a of the New York State Education Law provides that:

1. No person shall be expelled from or be refused admission as a student to an institution of higher education for the reason that he or she is unable, because of his or her religious beliefs, to register or attend classes or to participate in any examination, study, or work requirements on a particular day or days.
2. Any student in an institution of higher education who is unable, because of his or her religious beliefs, to attend classes on a particular day or days shall, because of such absence on the particular day or days, be excused from any examination or any study or work requirements.
3. It shall be the responsibility of the faculty and of the administrative officials of each institution of higher education to make available to each student who is absent from school, because of his or her religious beliefs, an equivalent opportunity to register for classes or make up any examination, study, or work requirements which he or she may have missed because of such absence on any particular day or days. No fees of any kind shall be charged by the institution for making available to the said student such equivalent opportunity.
4. If registration, classes, examinations, study, or work requirements are held on Friday after 4:00 p.m. or on Saturday, similar or makeup classes, examinations, study, or work requirements, or opportunity to register shall be made available on other days, where it is possible and practicable to do so. No special fees shall be charged to the student for these classes, examinations, study, or work requirements, or registration held on other days.
5. In effectuating the provisions of this section, it shall be the duty of the faculty and of the administrative officials of each institution of higher education to exercise the fullest measure of good faith. No adverse or prejudicial effects shall result to any student because of his or her availing himself or herself of the provisions of this section.
6. Any student who is aggrieved by the alleged failure of any faculty or administrative officials to comply in good faith with the provisions of this section shall be entitled to maintain an action or proceeding in the supreme court of the county in which such institution of higher education is located for the enforcement of his or her rights under this section.
7. It shall be the responsibility of the administrative officials of each institution of higher education to give written notice to students of their rights under this section, informing them that each student who is absent from school, because of his or her religious beliefs, must be given an equivalent opportunity to register for classes or make up any examination, study, or work requirements which he or she may have missed because of such absence on any particular day or days. No fees of any kind shall be charged by the institution for making available to such student such equivalent opportunity.
8. As used in this section, the term "institution of higher education" shall mean any institution of higher education, recognized and approved by the Regents of the University of the State of New York, which provides a course of study leading to the granting of a post-secondary degree or diploma. Such term shall not include any institution which is operated, supervised, or controlled by a church or by a religious or denominational organization whose educational programs are principally designed for the purpose of training ministers or other religious functionaries or for the purpose of propagating religious doctrines. As used in this section, the term "religious belief" shall mean beliefs associated with any corporation organized and operated exclusively for religious purposes, which is not disqualified for tax exemption under section 501 of the United States code.