

**SYLLABUS & COURSE INFORMATION**  
**MEC 364 – INTRODUCTION TO FLUID MECHANICS**  
**FALL 2019**

**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:** Thomas Cubaud

Office Hours: Monday (2:30 – 3:30 PM), Tuesday (12:00 – 2:00 PM)

Location: 218 Heavy Engineering Building

E-mail: [thomas.cubaud@stonybrook.edu](mailto:thomas.cubaud@stonybrook.edu)

**TEACHING ASSISTANTS:** Jay Gite (R01)

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Office Hours: Wednesday (11:30 AM – 1:30 PM) 158 Light Engineering

Georgios Dagkoulis (R02)

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Office Hours: Wednesday (11:30 AM – 1:30 PM) 158 Light Engineering

**WEEKLY SCHEDULE:** **LECTURE** – Monday, Friday (1:00 – 2:20 PM)

Location: Engineering Building, room 143

**RECITATION** – Wednesday (10:00 – 10:53 AM)

Recitation R01 location: Javits Lecture Hall, room 103

Recitation R02 location: Javits Lecture Hall, room 111

**TEXT:** Title – Introduction to Fluid Mechanics with WileyPLUS registration card for homework assignments

Authors – Fox, McDonald and Pritchard

Publisher – John Wiley & Sons, Inc., New York

**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 WileyPLUS registration code 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 Friday)	Recitations (Wednesday)
<b>Week 1</b> Aug. 26 – 30	<b>Chap. I</b> Introduction	<b>No recitation</b>
<b>Week 2</b> Sept. 2 – 6	<b>M (Sept. 02): No Class (Labor Day)</b> <b>Chap. II</b> Fundamental Concepts	<u>Rec. 1:</u> Ideal gas law and unit conversions HW#1 assigned
<b>Week 3</b> Sept. 9 – 13	<b>Chap. III</b> Fluid Statics	<u>Rec. 2:</u> Streamlines and shear stress <u>HW#1 due</u> , HW#2 assigned
<b>Week 4</b> Sept. 16 – 20	...	<u>Rec. 3:</u> Manometers <u>HW#2 due</u> , HW#3 assigned
<b>Week 5</b> Sept. 23 – 27	<b>Chap. IV</b> Basic Eq. in Integral Form for a Control Vol.	<u>Rec. 4:</u> Submerged plates <u>HW#3 due</u> , HW#4 assigned
<b>Week 6</b> Sept. 30 – Oct. 4	...	<u>Rec. 5:</u> Forces on curved surf. and mass conservation <u>HW#4 due</u> , HW#5 assigned
<b>Week 7</b> Oct. 7 – 10	<b>Chap. V</b> Differential Analysis of Fluid Motion	<u>Rec. 6:</u> Momentum equation in integral form <u>HW#5 due</u> , HW#6 assigned
<b>Week 8</b> Oct. 14 – 18	<b>M (Oct. 14): No class (Fall break)</b> <b>F (Oct. 18) Exam I (From HW/recitation #1 to #6)</b>	Review of previous problems for Exam I <u>HW#6 due</u>
<b>Week 9</b> Oct. 21 – 25	...	<u>Rec. 7:</u> Bernoulli Eq. and first law in integral form HW#7 assigned
<b>Week 10</b> Oct. 28 – Nov. 1	<b>Chap. VI</b> Dimensional Analysis and Similitude	<u>Rec. 8:</u> Continuity Eq., subst. derivative and vorticity <u>HW#7 due</u> , HW#8 assigned
<b>Week 11</b> Nov. 4 – 8	<b>F (Nov. 08) Exam II (from HW/recitation #1 to #8)</b>	Review of previous problems for Exam II <u>HW#8 due</u>
<b>Week 12</b> Nov. 11 – 15	<b>Chap. VII</b> Perfect Fluids	<u>Rec. 9:</u> Dimensional analysis and model study HW#9 assigned
<b>Week 13</b> Nov. 18 – 22	<b>Chap. VIII</b> Internal Incompressible Flows	<u>Rec. 10:</u> Navier Stokes Eq. <u>HW#9 due</u> , HW#10 assigned
<b>Week 14</b> Nov. 25 – 29	<b>M (Nov. 25) &amp; F (Nov. 29): No class (Thanksgivings)</b>	<b>No recitation (Thanksgivings)</b>
<b>Week 15</b> Dec. 2 – 6	<b>Chap. IX</b> External Incompressible Flows	Review of all previous problems <u>HW# 10 due</u>
<b>Final Week</b>	<b>Final Exam (Based on all material)</b>	

## 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 Student Accessibility Support Center, ECC (Educational Communications Center) Building, Room 128, (631)632-6748. They will determine with you what accommodations, if any, 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 Student Accessibility Support Center. For procedures and information go to the following web-site: <http://www.stonybrook.edu/ehs/fire/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](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 University 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.