**SYLLABUS**
**MENG 3104 - 101: Fluid Mechanics**
**(Required Course)**
**Fall 2022**

Instructors: Dr. Salim Azzouz and Dr. Mahmoud Elsharafi

Office No.: MY 219 G (Azzouz), MY 219F (Elsharafi)

Tel.: (940) 397-4301 (Azzouz), (940) 397-4551 (Elsharafi)

E-mails: salim.azzouz@msutexas.edu; mahmoud.elsharafi@msutexas.edu

Office Hours:  See instructors schedule on D2L and office door. All other times by appointment.

Course Schedule: MWF 9:00 - 9:50 AM. Lab. Schedules: (11A, T, 1:30 PM- 3:20 PM), (11B, W, 6:00 PM - 7:50 PM), (11C, R, 1:30 PM - 3:20 PM).

Locations: Lecture: MY136 – Labs: MY 123

## CATALOG DESCRIPTION
Fundamental principles of fluid mechanics, Properties of fluids, Fluid statics, Control volume and transport theorem, Bernoulli's equation, Continuity, momentum, and energy equations, Inviscid and viscous flow, Laminar and turbulent flows, Incompressible and compressible flows, Internal and external flows, Companion lab.

## COURSE PRE- and CO-REQUISITES
MENG 2203 (Thermodynamics).

## OTHER PREREQUISITES
Basic computer skills, MS Excel, MS Word, hand calculator.

## TEXTBOOK
Fundamentals of Fluid Mechanics, B.R. Munson et al., 9th edition (binder Version), ISBN: 978-1-119-721970, Publisher: John Wiley & Sons, Incorporated.

## REFERENCES
Additional material will be put online on D2L.

## TOPICS COVERED

- Introduction
- Fluid Statics
- Elementary Fluid Dynamics
- Bernoulli Equation
- Fluid Kinematics
- Finite Control Volume Analysis
- Differential Analysis of Fluid Flow
- Dimensional Analysis, Similitude, and Modeling
- Viscous Flow in Pipes

**COURSE LEARNING OBJECTIVES AND RELATIONSHIP TO PROGRAM EDUCATIONAL OUTCOMES**

| Outcome-Related Course Learning Objectives | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Determine the dimensions and units of physical properties | X | | | | | | |
| Calculate the hydrostatic pressure on a plane submerged surface | X | X | | | | | |
| Use Bernoulli equation to solve simple flow problems | X | X | | | | | |
| Identify various flow characteristics based on the velocity field | X | | | | | | |
| Apply conservation of mass and energy and Newton's second law of motion to the contents of a finite control volume to get important equations | X | | | | | | |
| Determine various kinematic elements of the flow given the velocity field | X | | | | | | |
| Apply the Buckingham Pi theorem | X | X | | | | | |
| Calculate losses in straight portions of pipes | X | X | | | | X | |
| Write formal and informal engineering reports | | | X | X | X | X | X |
| Work as a part of a team | | | X | X | X | | X |

**1: an ability to identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics**
**2: an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental, and economic factors**
**3: an ability to communicate effectively with a range of audiences**
**4: an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts**
**5: an ability function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives**
**6: an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions**
**7: an ability to acquire and apply new knowledge as needed, using appropriate learning strategies**

**CONTRIBUTION OF COURSE TO PROFESSIONAL COMPONENT**
This course contributes to the engineering science component of the mechanical engineering program.

**COURSE ORGANIZATION AND ASSESSMENT**

- **Lecture Format**
  This fall 2022 semester, the fluid mechanics course is offered as a face-to face in class lecture at the McCoy School of Engineering. The lecture consists of a three 50-minutes sessions scheduled MWF. The lectures will be spent mostly explaining and discussing concepts presented in the textbook, and solving relevant case problems. The Lectures will not be used to communicate the entire textbook course content and thus, students will have to study a set of course paragraphs specified by the instructor on their own to further their understanding. Student participation in class discussions is highly recommended and rewarded.

- **Exams**
  There will be two regular exams plus a final one at the end of the semester. Each exam will have a set of textbook theoretical questions designed to test the students' ability to acquire a self-reading knowledge of the taught materials. The exam has also a set of practical questions designed to test the students' ability to think, analyze, and solve engineering problems. Each exam is based on the course materials developed before the first exam or between two consecutive exams. All exams will be in-class exams. All solutions for the exam should be written on engineering paper sheets or blank paper sheets front side pages, and not back side pages. Exam solutions should be organized with the appropriate questions numbering, and neatly written. You are expected to take the exam on the scheduled date and time it is given. If for an exceptional or unforeseen reason, a student misses an exam, he will be asked to provide a valid and convincing proof on why he missed it. If the instructor accepts the proof and depending on his availability, the instructor will write a make-up exam that will be administered on an agreed date with the student. The make-up exam testing materials could be very different from the regular administered exam. During the exam, it is strictly forbidden to use cellphones or other electronic devices with the exception of a simple hand-calculator. All cellphones and other electronic devices will be collected at the beginning of the exam and restituted at the end of it.

- **Homework & Quizzes**
  Homework will be posted on D2L from a set of chosen chapters by the instructor. The students are required to upload the homework to a D2L Dropbox in a single PDF or Microsoft Word format; no other format will be accepted. The solutions of the homework should be written using the posted homework template, organized with the appropriate questions numbering, and neatly written. Homework solutions should be submitted with the posted homework questions sheet as a cover page for the whole homework submission. Homework have to be turned-in on the due date specified on the homework questions sheet. The maximum grade for the submitted homework on the due date is 60%. Late homework will still be accepted till the end of the semester and graded with a maximum grade of 30%. There will be a quiz question given along with each homework to encourage the students to study the course materials and do the homework by themselves. Quiz questions will consist of questions related to the ones treated in the current homework problems, but not exactly the same. Often you will be asked to use a software program to solve the quiz question. Quiz questions count for 40% of the homework & quiz question total grade and should be uploaded on the same file as the homework to a D2L Dropbox. Late quiz questions will still be accepted till the end of the semester and graded with a maximum grade of 20%. Each student is responsible for submitting his own individual personal homework and quiz question copy, written in his own words. No dual or group homework copy is accepted unless specified by the instructor.

- **Lab Reports**

  Beside the weekly three hours lectures, two hours will be dedicated to lab experiments, result analysis, and lab reports. Lab reports are based on the materials studied in class, or presented during lab sessions. Organized, neat Lab reports must be turned-in on the due date, at the beginning of class. Each group of students is responsible for submitting his own lab report in his own words. A student cannot add his name to a lab group of student if absent during that same lab. Labs are graded according to the grid listed in the below table. Students are encouraged to finish their lab and submit it during the lab session if possible.

  Arriving late to the lab or quitting the lab session without the instructor authorization will be penalized on the general attitude grade of the student. For lab guidelines, contents, scheduling, and late submissions, the students are referred to the labs instructor: Dr. Mahmoud Elsharafi.

| Submitted/Behavior | 10 | 9.5 | 9 | 8.5 | 8 | 7.5 | 7 | 6.5 | 6 | 5.5 | 5 | 4.5 | 4 | 3.5 | 3 | 2.5 | 2 | 1.5 | 1 | 0.5 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Motivation | 10 | 9.5 | 9 | 8.5 | 8 | 7.5 | 7 | 6.5 | 6 | 5.5 | 5 | 4.5 | 4 | 3.5 | 3 | 2.5 | 2 | 1.5 | 1 | 0.5 | 0 |
| Lab Theory | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Lab Procedure | 10 | 9.5 | 9 | 8.5 | 8 | 7.5 | 7 | 6.5 | 6 | 5.5 | 5 | 4.5 | 4 | 3.5 | 3 | 2.5 | 2 | 1.5 | 1 | 0.5 | 0 |
| Results and Discussion | 30 | 28 | 26 | 24 | 22 | 20 | 18 | 16 | 14 | 12 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Conclusion | 10 | 9.5 | 9 | 8.5 | 8 | 7.5 | 7 | 6.5 | 6 | 5.5 | 5 | 4.5 | 4 | 3.5 | 3 | 2.5 | 2 | 1.5 | 1 | 0.5 | 0 |
| Ref./Org./Neatness | 10 | 9.5 | 9 | 8.5 | 8 | 7.5 | 7 | 6.5 | 6 | 5.5 | 5 | 4.5 | 4 | 3.5 | 3 | 2.5 | 2 | 1.5 | 1 | 0.5 | 0 |

- **Course Grade**

  It is brought to the attention of the students that each one of them will be graded individually. There are strictly no collective grade for any of the listed graded items. The final grade for the course will be based on the scores earned in the three mandatory exams, the average score earned in the combined homework & quiz, the average score earned in lab reports, and the general attitude grade. The first exam contributes 10%, the second exam contributes 25%, the third exam contributes 35%, homework & quiz average contribute 10%, lab reports average contributes 10%, and class participation, returned copies neatness, student behavior, attitude, and class attendance contribute 10%, for a total of 100%. The overall average score (X) for the course is determined as follows:

  X = 0.10 x exam1 score + 0.25 x exam 2 score + 0.35 x Comprehensive exam score + 0.10 x (homework & quiz average score) + 0.10 x (lab report average score) + 0.10 x (participation/neatness/behavior/attitude/attendance scores/ethics).

  The final letter grade for the course is based on the value of X and is determined from the following grade levels:

| Value Range of X (in %) | Letter Grade |
|---|---|
| $90 \leq X \leq 100$ | A |
| $80 \leq X < 90$ | B |
| $70 \leq X < 80$ | C |
| $60 \leq X < 70$ | D |
| < 60 | F |

**CONFLICT RESOLUTION**

If a misunderstanding or a conflict arises between the student and the instructor. Please follow this conflict resolution procedure:

1) The student should contact the instructor face to face or via e-mail if there is an issue with the course or the instructor. The faculty and the student will discuss this face to face or via email. Hopefully a resolution is reached on the issue.

2) The student should notify the faculty via email again if the issue still did not get resolved after the first encounter or communication.

3) The student can then contact the Chair of the McCoy School of Engineering, Dr. Desai, face to face or via email, ([raj.desai@msutexas.edu](mailto:raj.desai@msutexas.edu)), and discuss this issue. Dr. Desai will discuss the issue at hand with the faculty member. Dr. Desai will discuss the result of this discussion with the student. Hopefully a resolution is reached on the issue after this.

4) The student should notify the Chair via email if the issue still did not get resolved.

5) The Chair will contact the Dean and try to resolve the conflict. In case the conflict deals with the student grade, she will forward the case to the Grade Appeals Committee if necessary.

**GENERAL GUIDELINES**
- Plan to spend at least 6 hours outside of class to study the material and to work on homework assignments, and lab experiments. Do not wait until the last day to start working on your report, or prepare for the exam.
- Read the course material before coming to class.
- Utilize the instructor office hours throughout the semester to seek explanations from the instructor.
- Use engineering or blank paper for all homework assignments and exams. Use a systematic approach to solve problems. If a problem involves drawing a graph, use Excel, or any other graphic software tool to draw the graph. In engineering, neatness is a must, not a luxury. Be advised that you will be penalized for a lack of neatness.
- You are strongly encouraged to study in-group. Time to time a lab partner will be randomly selected for you.

**UNDERGRADUATE RESEARCH INFORMATION**

**Research and Creative Activity Opportunities at MSU Texas**
Enhancing Undergraduate Research Endeavors and Creative Activities (EURECA) is a program that provides opportunities for undergraduates to engage in high-quality research and creative activities with faculty. EURECA provides incentives and funding through a system that supports faculty and students in a cooperative research process. For more information contact the Office of Undergraduate Research, (940) 397-6275 or by sending a message to eureca@msutexas.edu or better yet, stop by the UGR office located in the atrium of the Clark Student Center, room 161. Information and resources are available at [www.msutexas.edu/eureca](http://www.msutexas.edu/eureca).

**Council on Undergraduate Research (CUR)**
To support undergraduate research and creative activities, Midwestern State University holds an enhanced institutional membership with the Council on Undergraduate Research (CUR). This institutional membership includes unlimited memberships for any interested faculty, staff, and

students. Students may find information on benefits and resources at:
https://www.cur.org/engage/undergraduate/.

The CUR Undergraduate Resources Webpage contains:

- Research Opportunities
- Presentation Opportunities
- Undergraduate Research Journals
- CUR-Sponsored Student Events
- and more!

## UGROW

Like EURECA, the Undergraduate Research Opportunities and Summer Workshop, UGROW provides opportunities for students to conduct research with faculty.  However, the research occurs in the summer. For five weeks, UGROW students experience the authenticity of scientific research in faculty's laboratories, in a highly interdisciplinary environment. Students work on projects of their choice and present their findings at the end of program and the MSU Undergraduate Research Forum.  Faculty members publicize research projects in the spring.  The application deadline for UGROW 2023 has not been established yet; however, it will be announced in the upcoming spring semester.  Information and resources are available at www.msutexas.edu/ugrow.

## MIDTERM PROGRESS REPORT

In order to help students keep track of their progress toward course objectives, the instructor for this class will provide a Midterm Progress Report through WebWorld for at-risk students.  Midterm grades will not be reported on the students' transcript; nor will they be calculated in the cumulative GPA. They simply give students an idea of where they stand at the midpoint of the semester. Students earning below a C at the midway point should have a meeting with the professor and seek out tutoring. Please visit: https://msutexas.edu/academics/tasp/.

## CAMPUS CARRY STATEMENT

Senate Bill 11 passed by the 84th Texas Legislature allows licensed handgun holders to carry concealed handguns on campus, effective August 1, 2016. Areas excluded from concealed carry are appropriately marked, in accordance with state law. For more information regarding campus carry, please refer to the University's webpage at http://msutexas.edu/campus-carry/rules-policies.

## GENERAL EDUCATION STATEMENT

Students in this course must demonstrate their competency in oral and written communication through written homework assignments, lab reports, and exams. They must also demonstrate their ability to use the English language.

## ACADEMIC INTEGRITY POLICY AND ETHICS

Scholastic dishonesty will not be tolerated and will be prosecuted to the fullest extent. You are expected to have read and understood the current issue of the student handbook:
https://msutexas.edu/student-life/_assets/files/handbook.pdf.
regarding student responsibilities & rights, and the intellectual property policy information about procedures and what constitutes acceptable on-campus behavior. Any form of plagiarism will not be accepted, and will be heavily reprimanded. For more information, please visit the MCOSME student resources website: https://msutexas.edu/academics/scienceandmath/student_resources.php.

**DISABILITY SUPPORT SERVICES**

Students registered with Disability Support Services should have a letter verifying their disability and the appropriate accommodations.

**DISCLAIMER STATEMENT**

Information contained in this syllabus, other than grading, late assignments, makeup work, and attendance policies, may be subject to change with advance notice, as deemed appropriate by the instructor.

*Prepared by*: Dr. Salim Azzouz and Dr. Mahmoud Elsharafi, *Date*: 08/19/2022