Course Outline - Summer Session II 2017

MAE 101B - Advanced Fluid Mechanics

Mon., Wed. 11:00 AM - 1:50 AM (CSB 002)

Instructor:	Mr. Patrick Folz email: pfolz@ucsd.edu Office Hrs: Mon. and Wed. 9:00 AM - 10:00 AM EBU2 Room 370 (or by appointment)
Teaching Assistant:	Scott Carlson slcarlso@ucsd.edu Cynthia Wu yuw099@eng.ucsd.edu Discussion Session and Office Hrs: Tues. 10:00 AM - 12:00 Noon, EBU2 Room 105 Thurs. 1:00 PM - 2:00 PM, EBU2 Room 105 Fri. 1:00 PM - 2:00 PM, EBU2 Room 105
Prerequisites:	MAE 110A - Thermodynamics MAE 101A - Introductory Fluid Mechanics
Textbook:	**Fundamentals of Fluid Mechanics** B.R. Munson, T.H. Okiishi, W.W. Huebsch, A.P. Rothmayer John Wiley and Sons, Inc., Seventh Edition (2013)
Website:	TBA Announcements, Homework assignments and solutions.

Learning Objectives for MAE 101B

This course covers several topics in fluid dynamics beyond the material in the introductory course, including internal flows, external flows, and compressible flows. By the end of this course, you should be able to...

- ...explain the difference between laminar and turbulent flow, and the significance of the Reynolds number, to a fellow engineer.
- ...compute quantities of interest (flow rate, pressure drop, pump power, etc.) for a pipe system.
- ...explain the concept, physics and practical consequences of flow separation and the boundary layer to a fellow engineer.
- ...determine the lift and drag on an object immersed in fluid.
- ...explain to a non-engineer how airplanes fly.
- ...distinguish between incompressible and compressible flows, and justify (or not, as the case may be) the applicability of incompressiblility assumptions for a given flow.
- ...compute quantities of interest for isentropic and nonisentropic compressible flows (adiabatic).

For a full list of topics please consult the Course Decription in the UCSD student handbook.

Grading:

Pre-class Reading Quizzes - 6%
In-class Problems - 6%
Weekly Problem Sets - 19%
Internal Flow Quiz - 23%
External Flow Quiz - 23%
Compressible Flow Quiz - 23%

Tentative grade ranges: $> 90\%$ A, $> 77.5\%$ B, $> 65\%$ C. Thresholds may be lowered at the instructor's discretion, but will not be raised. No "D" grades will be given.

Re-grade requests must be made in a **written statement** detailing the justification for the re-grade (be sure to indicate: **name, date, email address**). Re-grades of problem sets will **not** be accepted beyond 1 week after return of homework. Pre-class quizzes **not** be re-graded.

Academic Policy:

All students are expected to know their responsibilities and uphold the standards of academic integrity and engineering professionalism. Students are encouraged to discuss course topics and homework with each other to promote learning. However **each student must do and submit their own work** on all homework assignments and exams. Submitted work that is copied or taken from an unauthorized source (e.g., another student's work) or performed using unauthorized resources (e.g., calculator programs or notes during exams) is considered cheating. Academic misconduct will have serious penalties and be reported to university administration. Refer also to class website for further information and **UCSD Policy on Integrity of Scholarship**.

Classroom Policy:

Students are expected to attend class regularly, arrive on time, and not disrupt the class unnecessarily. During collaborative activities with fellow classmates, **you must at all times treat your classmates with dignity and respect.** Disagreement is expected, and encouraged, but it should always focus on the problem at hand and never sink to the level of personal insults and such. Students who fail to conduct themselves in an appropriate manner may lose credit for the day's activity, be removed from class, and/or in severe cases be referred to the Office of Student Conduct, at the instructor's discretion.

Food:

As the course lectures are scheduled over the typical American lunch time, it is understood that you may get hungry while class is in session. It is requested that you **plan to eat before or after the scheduled lecture time** if at all possible. However, if this is not feasible, you may eat and drink in class *so long as*: 1)they do not make a mess, 2)there is no noticeable noise or smell. Repeated complaints from other students and/or Facilities Management may result in loss of eating privileges for everyone.

Course Structure and Philosophy

Instruction for this class takes several forms, including pre-class reading assignments, lectures, in-class problems and discussions with classmates, weekly problem sets, and so on. **The idea is to maximize the learning that occurs during each class**, as opposed to the instructor lecturing the material for 170(!) minutes and then afterwards you have to go home and practice it completely by yourself. The

Teaching Assistants will also hold discussion sessions and office hours if further assistance is desired; sometimes it is beneficial to hear from a different voice.

Points are given for the pre-class assignments and in-class problems to encourage you to do them. Reading some material ahead of class allows more class time to be devoted to difficult and/or higher-level topics; as such, **lengthy in-class reviews of the assigned reading material will usually not occur**. The **in-class activities are intended to be low-consequence opportunities for you to practice what you've learned**, receive feedback, and identify areas of your knowledge and skills that are particularly strong or need improvement. From time to time I need to assess how well you are learning, which will be done in the form of weekly problem sets and in-class quizzes. **Each component of the overall course grade is intentionally kept to a relatively small percentage so that the stakes of any one thing are relatively low**: an abnormally-subpar performance will not wreck your grade, and you can improve your learning habits (and scores) if early results are not to your liking. In this way, I hope you can focus on learning the material without worrying about grades.

Description of Grading Components

Quizzes:

Three quizzes, each approximately 60 minutes long, will be given. Each Quiz will primarily correspond one of the three chapters we cover in this course, but **all material prior to the quiz may be included**. The third Quiz, covering Chapter 11 (compressible flow), will constitute the "Final Exam" for the course and will be given during the scheduled Final time (Friday, September 8th at 11:30 AM, in room TBA).

Retake : You **may** "retake" either of the first two Quizzes during the scheduled Final time. The Retake Quizzes will be a new 60 minute Quiz consisting of different problems covering the same material, so for example Quiz 1 Retake will have only problems pertaining to Chapter 8, but they will not be the same problems as were asked on 8/16 (similarly for the Quiz 2 Retake). **The score on the retake will replace your prior score on the equivalent quiz, *no matter whether it is higher or lower***. If you wish to retake either or both of the Quizzes, **you must notify the instructor by 11:59 PM on Wednesday, September 6** of which quiz(zes) you intend to retake. This retake policy covers Quizzes missed for any reason.

OSD: Students registered with **OSD** and require alternate/additional accommodations should **contact the instructor** at least 72 hours before the start of each quiz to make arrangements.

Final:

The third Quiz, covering Chapter 11 (compressible flow) will be given during the University-specified Final time on **Friday, September 8 at 11:30 AM-2:29 PM location TBA. No makeups or retakes will be given.**

In-Class: Problems

Textbook problems will be asked during each lecture.
Grading : Scores are based on **participation only**, there is no penalty for answering incorrectly. Worksheets are to be submitted to the instructor before you leave class.

Homework:

There are two kinds of homework for this class: **daily readings and an associated test** to be done on TritonEd, and **weekly problem sets** due at the beginning of the designated class. **Late homework will not be accepted under any circumstances**.

Daily reading assignments and associated test on TritonEd are to be done **before** the start of class. They will be posted the afternoon before and must be done by 10:00am of the day of the corresponding class time.
Grading : scoring 80% or higher on **each test** will earn a full reading point for the day. Scores lower than 80% will receive proportional partial credit as though 0.8 were the max, so e.g. a score of 3/5 would earn $0.6/0.8 = 0.75$ pts. Final score for this component of the overall will be computed as (sum of TritonEd test points)/8 with a maximum score of 8/8, i.e. the lowest 2 scores are dropped.
Problem sets will be assigned each week and collected on specified due date/time. **Late homework will not be accepted under any circumstances**. The submitted homework must follow specific requirements. See attached sheet - **Homework Assignment Requirements**. Following the specified homework format may account for up to 5% of a given problem set score. Solutions will be available on TritonEd after submission. Since due to time constraints graded homework might not be returned before the relevant Quiz, you are strongly encouraged to seek help from the Teaching Assistants, the instructor, and fellow classmates, both prior to and after submission (i.e., to understand the solution), but **the work you submit must be your own**. See **Academic Policy**.

If 90% of students fill out a CAPE evaluation for this course, the lowest problem set score will be dropped.
Homework re-grade requests must be made in a **written statement** detailing the justification for the re-grade (be sure to indicate: **name, date, email address**). Re-grades will **not** be accepted beyond 1 week after return of homework.

MAE 110A - Homework Assignment Requirements

Homework assignments have the following requirements. **Any homework not following these requirements may be penalized or returned ungraded**.

1. All homework must be done **neatly** on $8\frac{1}{2} \times 11$ paper (clean, new paper, no ink bleedthrough, stapled together, no frayed edges) with each problem and final solution **clearly indicated**. The following information must appear on the **first/cover page**:

   - Name and Date
   - Course number
   - Homework number

   Illegible homework will be returned ungraded.

2. The following is the **standard format** for organizing and presenting the solution to each homework problem† (See sample solution on next page):

   (a) **Problem Description** - include the following (*** very important**):
   - Basic description and given information
   - *Sketch of problem/geometry
   - *clearly indicate the **system** considered (use dashlines on schematic for system)
   - What is to be determined

   (b) **Engineering Model** - *list all required simplifying assumptions and idealizations.

   (c) **Basic Equations** - general form of relevant fundamental laws, equations, definitions.

   (d) **Analysis**
   - clear demonstration of procedure to reduce basic equations to give solution.
   - *keep equations in variable form (no numbers) for as long as possible.
   - identify all tables and charts needed for additional data, property values
   - Appropriate property diagrams (indicate state points, process lines) (e.g., "..from Table B.1.1").
   - substitute numerical values into final equations. be sure to specify all units and unit conversions.
   - *clearly indicate final answer(s) with underline or box.
   - check solution - correct sign, reasonable numerical values?)

   (e) **Discussion of Solution** - as needed (what you learned, key aspects of solution, etc).

   † Note: Some problems may not require all the above items. Follow the standard format as best as you can or as appropriate.

3. Grades will be determined by student's:

   - Understanding of the problem.
   - Identification of necessary procedure to obtain solution.
   - Clear and precise description of solution.
   - Correct numerical answers.

MAE 101B Tentative Class Schedule - Summer II 2017

Day	Topic	Reading
	Internal Incompressible Viscous Flows	
8/7	Course Information	Ch 8
	fully developed laminar flow	”
8/9	fully developed turbulent flow	”
	dimensional analysis: friction factor, Moody chart	”
8/14	energy equation, major and minor losses	”
	pipe systems	”
8/16	**QUIZ 1 - Internal Incompressible Viscous Flows (Ch 8)**	
	External Incompressible Viscous Flows	Ch 9
	boundary layer flow	”
8/21	flat plate boundary layer, Blasius solution	”
	integral analysis	”
8/23	boundary layer with pressure gradient	”
	flow about immersed bodies - drag and lift	”
8/28	**Compressible Flow**	Ch 11
	review of thermodynamics, Mach number, speed of sound	”
	propagation of sound waves, Mach cone	”
	isentropic flow with area change	”
8/30	**QUIZ 2 - External Incompressible Viscous Flows (Ch 9)**	
	Compressible Flow, cont.	”
	isentropic flow with area change cont’d.	”
9/4	LABOR DAY	
	no lecture	
9/6	converging and diverging nozzles cont’d	”
	Non-Isentropic Flow:	”
	normal shock waves	”
	*constant area adiabatic flow with friction: Fanno flow	”
	*constant area frictionless flow with heat transfer: Rayleigh flow	”
	*oblique shock waves	”
9/8	**FINAL incl. QUIZ 3 - Compressible Flow (Ch 11)**	
	(11:30am - 2:29pm, room TBA)	

* indicates topic will be covered as time permits