San José State University
Mechanical Engineering Department
ME 221 Viscous Flow Analysis and Computation, Fall 2019

Course and Contact Information

Instructor:	Crystal Han
Office Location:	Engineering Building Room 310C
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Email:	crystal.m.han@sjsu.edu
Office Hours:	Tues/Thurs 3:15 – 4:15 or by appointment
Class Days/Time:	Tues/Thurs 4:30-5:45 PM
Classroom:	Engineering Building Room 301
Prerequisites:	BSME or instructor consent

Course Format

The course will take the format of combined lecture and worksheet. During the worksheet session, you will solve problems related to the lecture in-class where discussion with other students is highly encouraged. Lectures will be delivered in class via written notes. If PowerPoint slides are used, those will be posted to Canvas, along with the syllabus, announcements, grades, and so on. You are responsible for checking the class page regularly to keep up to date on coursework. I strongly suggest having all announcements forwarded to an email address you check daily. To use Canvas, use the link https://sjsu.instructure.com/, and login with your 9-digit SJSU ID and password. If you have any questions about using Canvas, please see me or visit http://www.sjsu.edu/at/ec/canvas/student_resources/index.html. If you need to meet with me outside of office hours, please email me for an appointment.

Course Description

The Navier-Stokes equations for laminar flow; exact solutions, lubrication theory and boundary layer forms with computer-based solution techniques. Reynolds-averaging and turbulent flow; solution of the Reynolds-averaged full and boundary layer equations using computers.

Course Learning Outcomes (CLO)

Upon successful completion of this course, students will be able to:

1. Understand basic principles of fluid properties.
2. Classify a flow as uniform or non-uniform, steady or unsteady, incompressible or compressible, laminar or turbulent, 1-D, 2-D, or 3-D.
3. Derive differential forms of governing equations of motion for viscous flows.
4. Identify, formulate and analytically solve simple flow problems.
5. Analyze fluid flow problems and make approximate assumptions for specific engineering applications.
6. Use computational tools to obtain numerical solutions of complex engineering fluid flow problems.

Required Texts/Readings

Textbook

- Lecture notes and handouts
- At least one from the reference list below.

References

1. Cengel and Cimbala, Fluid Mechanics: Fundamentals and Applications, 4th ed., 2018
2. White, Fluid Mechanics, 8th Edition, McGraw Hill, 2016
3. White, Viscous Fluid Flow, 3rd Edition, McGraw Hill, 2006
4. Kundu et al., Fluid Mechanics, 6th Edition, Elsevier, 2015
   This book can be accessed for free as an E-book from SJSU library:
   https://ebookcentral.proquest.com/lib/sjsu/reader.action?docID=534929

Other technology requirements

MATLAB will be required for completing homework problem sets. It is installed in all computers in ME computer lab (E215) for ME students. If you are from other departments and want an access to ME computer lab, please contact me.

Library Liaison

Rachel Silverstein
Phone: 408-808-2106
Email: rachel.silverstein@sjsu.edu
Subject guide: http://libguides.sjsu.edu/me

Course Requirements and Assignments

"Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally three hours per unit per week) for instruction, preparation/studying, or course related activities, including but not limited to internships, labs, and clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus."

Proof of Prerequisites

If you do not have a BSME, please email me with a brief explanation of your background before the **second day of class**. The email should include your current student status (undergraduate or graduate), department, and previous coursework related to multivariable calculus (solving ODEs and PDEs) and fluid mechanics, and the institution that you took the courses. The instructor consent will be given after reviewing the information.

Homework

Homework will be assigned weekly on most weeks. The due dates are specified in the course schedule at the end of this syllabus. **Hand-written hard copy** solutions must be turned in **before the class starts** on due dates. **Late submission will be accepted only until 11:59 pm of the due date, and there will be 50% deduction on earned points.**

Worksheets

In most classes, there will be a time allocated for worksheets. Up to 3 people can work on the worksheet together, and each group will turn in a single completed worksheet at the end of the class. Group discussion is highly encouraged over individual work. **No late submission will be accepted in any case. However, the 3 lowest worksheet scores will be dropped.**

Midterms

There will be two midterm exams on the dates specified in the course schedule at the end of this syllabus. The exam is cumulative, that is, midterm 2 will include the materials covered in the midterm 1.

Final Examination

A cumulative final exam will be given at **2:45 pm – 5:00 pm on Tuesday, Dec 17th**.

Exam Protocols

All exams (quizzes, midterms, and final) will be **CLOSED BOOK and CLOSED NOTES with one single or double-sided 8.5 by 11 inch equation sheet allowed**. **No electronic device** (cell phones, tablets, etc.) will be allowed during the exams. Make sure you bring your physical engineering calculator. Cell phone calculators will not be allowed. Violation of academic integrity will result in zero in the exam and a report to Student Conduct and Ethical Development.

Without a documented excuse, exams must be taken on the indicated dates. If you have any serious problems with the examination dates, please see me ASAP. An alternative arrangement can be made in case of college-approved circumstance (e.g. participating a technical conference related to work with SJSU faculty). The request for exam rescheduling should be made a minimum of three weeks before a scheduled midterm exam or four weeks for final exams.

Grading Information

Grade Weighting

Homework	20%
Worksheets	10%
Midterms (20% each)	40%
Final Exam	30%*

*An exceptional final exam (10% higher than your average grade before the final) will result in the final exam being weighted at 40% of your final grade, with the weight of the other items being decreased proportionally.

Determination of Grades

Letter Grade	Score
A plus	97.0 to 100
A	93.0 to 96.9
A minus	90.0 to 92.9
B plus	87.0 to 89.9
B	83.0 to 86.9
B minus	80.0 to 82.0
C plus	77.0 to 79.9
C	73.0 to 76.9
C minus	70.0 to 72.9
D plus	67.0 to 69.9
D	63.0 to 66.9
D minus	60.0 to 62.9

Grading Philosophy

In engineering, getting the right answer is obviously important, but in this class, I am more concerned with helping you become good problem-solvers, not good answer-finders. This means that the process will be weighted more heavily than the getting the number right. The more clearly you write your solution, the easier it is for me to give partial credits for process.

Grade Errors and Regrades

Clear grading errors (points added or recorded incorrectly) may be corrected at any time. Regrading (when you believe you deserve more points for something) may only be requested *within two weeks of the assignment due date*. To bring an error to my attention or request a regrade, please return the document to me in class with an attached note about why you believe you deserve more points.

Extra credits

In some worksheet problems, there are extra credit problems available. No other extra credit will be made.

Classroom Protocol

Please place your cellphones on silent and refrain from using them during class. If you absolutely must take an emergency phone call, please leave the room quietly to do so. Important announcements and homework submission will be at the beginning of class at the beginning of class, so please be punctual. Bring an engineering calculator for worksheets and be ready for in-class worksheet activities.

University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus Information page at http://www.sjsu.edu/gup/syllabusinfo/"

Academic integrity

Your own commitment to learning, as evidenced by your enrollment at San José State University and the University's Academic Integrity Policy (http://www.sjsu.edu/studentconduct/docs/Academic%20Integrity%20Policy%20F15-7.pdf), requires you to be honest in all your academic course work. Faculty members are required to report all alleged violations of the Academic Integrity Policy to Student Conduct and Ethical Development. Instances of academic dishonesty will not be tolerated. Cheating or plagiarism will result in a zero in the exam involving the instance of academic dishonesty and administrative sanctions by the University.

"SOS!"

Sometimes, life happens. If you are really struggling with the course material, and/or if something is going on outside of class that may significantly disrupt your studies (financial concerns, upheaval in your home life, physical or mental health issues, etc.), I will do everything I can to help you succeed. If I am personally unable to help you, I will direct you to the appropriate resource. I will maintain a list on Canvas of all the resources available to you as an SJSU student. The earlier you ask for help with a problem, the easier it is to solve.

ME 221: Viscous Flow Analysis and Computation, Fall 2019 Tentative Course Schedule

Date	Topics	Related Reading	Dues
Aug-22	Syllabus, Basic Concepts	C1.1-1.6, 2.6, W1.1-1.7, K1.1-1.5	
Aug-27	Fluid properties, vector calculus review	Chapters above + handout, K2.1-2.5	
Aug-29	Fluid kinematics, control volume analysis	C4.1-4.6, W3.1-3.4, V1.3, K3.1-3.8	HW1
Sep-3	Continuity equation, stream function*	C9.1-9.3, W4.1-4.2, 4.7, K4.1-4.3	
Sep-5	Navier-Stokes equation	C9.4-9.5, W4.3, K4.6-4.7, 4.11	HW2
Sep-10	Couette and Poiseuille Flows **	C9.6, W4.10, V3.2-3.2, K9.4-9.6	
Sep-12	Couette and Poiseuille Flows	Same as above	HW3
Sep-17	Unsteady parallel flow	V3.5, K9.7	
Sep-19	Unsteady parallel flow	Same as above	HW4
Sep-24	Nondimensionalization	C10.1-10.2 V2.9	
Sep-26	Inviscid and irrotational flow	C10.4-10.5, W4.9, 8.1-8.4. K6.1-6.9	HW5
Oct-1	**Midterm 1**		
Oct-8	Potential flow	Same as above	
Oct-10	Lubrication theory	V3.9.8	
Oct-15	Lubrication theory	Same as above	HW6
Oct-17	Creeping flow	C10.3, V3.9, K9.11-13	
Oct-22	Stokes' solution	Same as above	HW7
Oct-29	Laminar Boundary layers	C10.6, W7.1-7.5, V4.1-4.3, K10.1-10.8	
Oct-31	Laminar BL: Blasius Solution	Same as above	HW8
Nov-5	Laminar BL: displacement and momentum thickness	Same as above	
Nov-7	Laminar BL: Momentum integral technique	Same as above	HW9
Nov-12	**Midterm 2**		
Nov-14	Laminar BL: BL with pressure gradient	Same as above	HW10
Nov-19	Turbulent flows	V6.1,6.2,6.6, W6.5, K13.1-13.3,13.5	
Nov-21	Reynold's averaged turbulent equations	Same as above	HW11
Nov-26	Turbulent flat plate boundary layer	Same as above	
Nov-28	No class (Thanksgiving Holiday)		
Dec-3	Introduction to computational fluid dynamics	V3.10, W8.9, K11.1	
Dec-5	Review		HW12
Dec-17	**FINAL EXAM 14:45-17:00 pm (Tuesday)**		

*Sep-3: Last day to drop without an entry on your permanent record
**Sep-10: Last day to add a class and register late
W: White Fluid mechanics, V: Viscous fluid flow by White, C: Cengel Fluid mechanics, K: Kundu