San José State University
Department of Mechanical Engineering
ME 271Computational Fluid Dynamics for ME (Applications)
Section 01, #25013, Spring 2022

Instructor: Dr. Ernest M.Thurlow

Office Location: Online

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Office Hours: Before Class: 7:00-7:30pm and After Class 8:45-9:15pm or by appointment

Office Zoom Mtg: **https://sjsu.zoom.us/j/87545948741?pwd=NzAwTVVUTHFTSks2V3hjcGRhZEJwZz09**

Mtg ID: 875 4594 8741, Password: 276457

Class Days/Time: Monday and Wednesday/7:30-8:45pm

Class Zoom Mtg: https://sjsu.zoom.us/j/89180151545?pwd=bU9xK3ljdUh2YVRnNExxOUIvckpRZz09
Mtg ID: 891 8015 1545, Password: 405546

Classrooms:ENGR 213 (As scheduled with Modality/TBD 01/19/22)

Prerequisites:BSME or Instructor's Consent

Canvas and Course Messaging

Copies of the course materials such as the syllabus, assignments, exam review material, Powerpoint presentations, etc. may be found on the Canvas site for the class. This system will also show you your grades, and it allows you to have discussions or chat with the class. This feature may be especially helpful if you need assistance on a homework problem. Homework assignments and electronic classroom materials (such as Powerpoint slides) are posted on this site.

To log in, go to the Canvas URLhttp://sjsu.instructure.com. Log in with your 9-digit SJSU ID and password you use for your SJSUOne account. For questions on the use of Canvas, please check out http://www.sjsu.edu/at/ec/canvas/student_resources/index.html

ME271 CANVAS Website: SP22: ME-271 Sec 01 - Comp Fluid Dyn ME (instructure.com)

You are responsible for regularly checking with the messaging system through Canvas. You can set up your Canvas account to forward all email sent to your Canvas account to any other email address you wish.

Course Description

Course provides an in-depth introduction to the methods and analysis techniques used in computational solutions of fluid mechanics and heat transfer problems. Model problems are used to study the interaction of physical processes and numerical techniques. Contemporary methods for mesh generation and analysis of boundary layers and incompressible viscous flows are studied.

Application using a commercial CFD package is performed. ANSYS Fluent and ANSYS Icepak are the main CFD softwares utilized, but other CFD software applications may be introduced.

Course Goals and Student Learning Objectives

By the end of this course, students should be able to

- Describe the governing equations of incompressible flows and their mathematical properties.
- Describe the setup of the finite volume and finite difference methods and their limitations.
- Formulate a mesh that results in accurate analysis of a thermal-fluid system and demonstrate its accuracy.
- Describe methods of modeling turbulence and choose an appropriate model for a given thermal-fluid system.
- Apply appropriate boundary conditions for a given thermal-fluid application.
- Demonstrate a systematic application of the principles and describe the limitations of techniques for the simulation of turbulent and transitional flows and thus be able to apply these in a critical manner to practical applications.
- Demonstrate their acquired skills in applying commercial CFD software packages to practical engineering applications.

Required Texts/Readings

"An Introduction to ANSYS Fluent 2020" by John E. Matsson, SDC Publications, 2020

Additional Texts/Readings

Text 2."Heat and Mass Transfer , A Practical Approach" 4th Edition by Yunus A. Cengel
Text 3. *"*Engineering Fluid Mechanics*"*, by Crowe, Elger, Williams & Robertson, John Wiley & Sons, Ninth Edition, 2009, or similar fluid mechanics textbook
Text 4."Thermodynamics:An Engineering Approach" 6th Edition by Y.A.Çengel and M.A.Boles, or similar thermodynamics textbook.

Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester's Catalog Policies section at http://info.sjsu.edu/static/catalog/policies.html. Add/drop deadlinescan be found on the current academic calendar web page located at http://www.sjsu.edu/academic_programs/calendars/academic_calendar/.The Late Drop Policy is available at http://www.sjsu.edu/aars/policies/latedrops/policy/**.** Students should be aware of the current deadlines and penalties for dropping classes.

Information about the latest changes and news is available at the Advising Hub at http://www.sjsu.edu/advising/.

Assignments and Grading Policy

Grade Distribution

		A	93.0-100	A-	90.0-92.9
B+	87.0-89.9	B	84.0-86.9	B-	80.0-83.9
C+	77.0-79.9	C	74.0-76.9	C-	70.0-73.9
		D	60.0-69.9		

Homework	30%
Project	20%
Midterm	20%
Final Exam	30%

Expected Time Commitment

According to university rules: "Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of forty-five hours over the length of the course (normally 3 hours per unit per week with 1 of the hours used for lecture) for instruction or preparation/studying or course related activities including but not limited to internships, labs, clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus."

University Policies

Academic integrity

Your commitment as a student to learning is evidenced by your enrollment at San Jose State University. TheUniversity's Academic Integrity policy, located at http://www.sjsu.edu/senate/S07-2.htm, requiresyou to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The Student Conduct and Ethical Development websiteis available at http://www.sa.sjsu.edu/judicial_affairs/index.html.

Instances of academic dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person's ideas without giving proper credit) will result in a failing grade and sanctions by the University. For this class, all assignments are to be completed by the individual student unless otherwise specified. If you would like to include your assignment or any material you have submitted, or plan to submit for another class, please note that SJSU's Academic Policy S07-2 requires approval of instructors.

The best way to handle homework is to struggle through it in your own first. Use your book and notes to help you. Then if you're stuck, ask your instructor or friends from class for hints. You are welcome to compare homework answers or solution methods with your friends after you have completed your problems.

Campus Policy in Compliance with the American Disabilities Act

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 requires that students

with disabilities requesting accommodations must register with the Disability Resource Center (DRC) at http://www.drc.sjsu.edu/ to establish a record of their disability.

Student Technology Resources

Computer labs for student use are available in the Academic Success Center located on the 1st floor of Clark Hall and on the 2nd floor of the Student Union. Additional computer lab share available in ENG 213/215/394. Computers are also available in the Martin Luther King Library.The software used in this class, FLUENT, is available in ENG 213/215/394. It is also available for download. Instructions will be provided in class.

ME 271 Schedule Spring 2022, Section 1

Date	Topic	Introduction to ANSYS Fluent, Handouts, Online Tutorials	HW due
26-Jan	Introduction to CFD, Numerical Methods, Flow Regimes to be Considered, Conservation Equations and Introduction to ANSYS Fluent	SpaceClaim Handouts Fluent Tutorial Intro_16.0_L02_IntroCFD	
31-Jan	Fluent Modeling 1, Introduction to Model Setup Requirements/SpaceClaim(Take Detailed Notes!)	Handouts (Develop. Pipe Flow) SpaceClaim Handouts	
2-Feb	Fluent Modeling 1, Introduction to SpaceClaim and Options	Chp. 2, Flat Plate Boundary Layer (w/ SClaim)	
7-Feb*	Fluent Modeling 1, Flat Plate Flow Analysis (Fluent vs Blasius Soln Analytic Analysis) (*Last Day to Drop Class is Feb 8)	Chp. 2, Flat Plate Theory & Cornell SimCafe w/ SpaceClaim (Flat Plate Flow) (2-D)	
9-Feb	Fluent Modeling 2, Flow Past Cylinder, Hmwk1 Due	Chp. 3, Flow Past Cylinder and Karman Vortex Street & Cornell SimCafe (2-D)	√
14-Feb**	Fluent Modeling 2, Flow Past Cylinder	Chp. 3, Flow Past Cylinder and Karman Vortex Street & Cornell SimCafe (2-D)	
16-Feb	Fluent Modeling 3, Channel Flow	Chp. 6, Channel Flow, & Cornell SimCafe	√
21-Feb	Icepak Modeling 3, Icepak Introduction and Simulation Procedures	Icepak Lecture Notes and Videos	
23-Feb	Icepak Modeling 3, Icepak Geometry Setup for Heatsink Sizing for Chip Package, Hmwk#3 Review	Icepak Lecture Notes and Videos	√
28-Feb	Icepak Modeling 4, JEDEC Board Chip Package Simulations and Characterization. Utilization of Chip Package Datasheets.	Icepak Lecture Notes and Videos	
2-Mar	Icepak Modeling 4, JEDEC Board Chip Package Simulations and Characterization Continued	Icepak Lecture Notes and Videos	√
7-Mar	Icepak Modeling 5, 2xPCIE GPU Card Thermal Design using GPU, Memory, Vregs, and Blower.	Icepak Lecture Notes and Videos	
9-Mar	Icepak Modelinng 5, 2xPCIE GPU Card Thermal Design using GPU, Memory, Vregs, and Blower.Continued	Icepak Lecture Notes and Videos *Fluent Intro_16.0_L05_SolverSettings and Meshing*	
14-Mar	Model Rocket Flow (Show Development Only)	Chp. 13 Model Rocket Flow	√
16-Mar	Turbulence Modeling, k-- ε, LES model introduction	Intro_16.0_L07_Turbulence	
21-Mar	Midterm Review and Fluent Best Practices for Minimizing and Debugging Errors	Fluent Tutorials Contd. Intro_16.0_L11_ReviewCourse	
23-Mar	Midterm Exam 1		
28-Mar	*Spring Recess- No Class*:		
30-Mar	*Spring Recess- No Class*:		
4-April	Fluent Modeling 6:Falling Sphere, VOF, Hydraulic Jump, UDF Programming	Chp. 17 and Fluent Tutorials Into_16.0_Appendix_UDF Into_16.0_L10-Transient	
6-April	Fluent Modeling 6:Falling Sphere, Moving Wall, VOF, Hydraulic Jump, Transient UDF.	Chp. 17 and Fluent Tutorials Into_16.0_Appendix_UDF Intro_16.0_L10-Transient	√
11-April	Fluent Modeling 7: Hourglass, Transient	Chp Handouts, Fluent Tutorials Intro_16.0_Appendix_Moving_Zones	
13-April	Fluent Modeling 7: Hourglass, Transient		
18-April	Fluent Modeling 8: Multiphase Flow Analysis (VOF Continued)	Fluent Tutorials Intro_16.0_Appendix_Multiphase	√
20-April	Fluent Modeling 8: Multiphase Flow Analysis, VOF Analysis, (Inkjets, Fuel Injectors, Heating Coffee Cup)	Fluent Tutorials Intro_16.0_Appendix_Multiphase	
25-April	Fluent Modeling 9: Combustion Using Species, PDF Table Generation, Energy Equation and Radiation	Fluent Tutorials Intro_Combustion_15.0_L02-Non-Premixed	
27-April	Fluent Modeling 9: Fluent vs. Stoich Eqns, Mass Flow Calcs, & Adiabatic Flame Temperature Calcs		
2-May	Fluent Modeling 10: for Airfoil	Chp. 4 Flow Past Airfoil & Cornell SimCafe	√
4-May	Fluent Modeling 10: for Airfoil	Chp. 4 Flow Past Airfoil & Cornell SimCafe	
9-May	Project Presentations		
11-May	Project Presentations		√
16-May 23-May	Review & Course Critique Monday, 7:45-10:00pm Final Exam		

* Last day to drop a class is Feb. 7th. ** Last day to add a class is Feb14th.***In-class assignment will count as part of your homework grade.