San José State University
Department of Mechanical Engineering
ME 271 Computational Fluid Dynamics for ME (Applications)
Section 01, #47777, Fall 2019

Instructor: Dr. Ernest M.Thurlow

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

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

Classrooms:ENGR 213

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 URL http://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: https://sjsu.instructure.com/courses/1321529

You are responsible for regularly checking with the messaging system through Canvas. You can set up your Canvasaccount 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.

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

Textbook

"An Introduction to Computational Fluid Dynamics: The Finite Volume Method (2nd Edition)" by H.K. Versteeg and W. Malalasekera, Longman Scientific & Technical. (or similar)

Droppingand 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

GradeDistribution

		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	20%
Projects	30%
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 labsare 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 Fall 2019, Section 1

Date	Topic	2nd ed. reading	HW due
21-Aug	Introduction to CFD, Numerical Methods, Flow Regimes to be Considered, Conservation Equations and Introduction to ANSYS Fluent	Chp. 1 Chp. 2, Handouts Intro_16.0_L02_IntroCFD	√
26-Aug 28-Aug	Fluent Modeling 1, Introduction to Model Setup Requirements/SpaceClaim(Take Detailed Notes!) Fluent Modeling 1, Inctroduction to SpaceClaim and Optiions	Chp. 2, Handouts SpaceClaim_Intro	
2-Sept* 4-Sept**	*Labor Day- No Class*: Finite Volume/Difference (PDE Equation Types) and Analytic Flat Plate Flow Modelling (Sept. 3, 2019, Last Day to Drop a Class)	Chp. 2, Handouts Cornell Confluence	√
9-Sept 11-Sept	Fluent Modeling 2, Flat Plate Flow Analysis (Fluent vs Blasius Soln Analytic Analysis) Finite Volume/Difference (PDE Equations), Internal Flow Analysis & Analytic Equations (Sept. 10, 2019, Last Day to Add a Class)	Chp. 2, Handouts Cornell Confluence	√ √
16-Sept 18-Sept	Fluent Modeling 3, Internal Flow Analysis and Fully Developed Length Analysis Implementation of Boundary Conditions and Initial Conditions	Chp. 9 Fluent Tutorials Intro_16.0_L08_HeatTransfer	√
23-Sept 25-Sept	Fluent Modeling 4, JEDEC Board Natural Convection vs Rayleigh/Richardson # Analytical Thermal Calculations Meshing, Cartesian, Hexa Unstructured, Hexa Dominant, Viscid and Inviscid Flows	Chp. 11 Fluent Tutorials Intro_16.0_L09_BestPractices	√
30-Sept 2-Oct	Fluent Modeling 5, Cylindrical and Cuboids, Steady/Unsteady, Viscid/ Inviscid Flows Solver Settings (k - ε model and Upwind Model) and Post Processing in Detail	Chp. 3 Fluent Tutorials Intro_16.0_L05_SolverSettings	
7-Oct 9-Oct	Fluent Modeling 6, Sudden Pipe Expansion Turbulence Modeling, k-- ε, LES model introduction	Chp. 3 Fluent-Tutorials Intro_16.0_L07_Turbulence	√
14-Oct 16-Oct	Fluent Modeling 7, Turbulent Pipe Flow vs. Jet Speed vs. Cooling (0 vs. 2 eqn models) Midterm Review and Fluent Best Practices for Minimizing and Debugging Errors	Fluent Tutorials Contd. Intro_16.0_L11_ReviewCourse	
21-Oct 23-Oct	Midterm Exam 1 *Spring Recess- No Class*:		
28-Oct 30-Oct	Transient Analysis, Moving Wall B.C, VOF, Hydraulic Jump, UDF Programming Fluent Modeling 8, 3-D Moving Wall, VOF, Hydraulic Jump, Transient UDF.	Chp. 3 Fluent Tutorials Into_16.0_Appendix_UDF Intro_16.0_L10-Transient	√
4-Nov 6-Nov	ANSYS Lecturer or Visiting Lecturer Fluent Modeling 8 Complete & 2-D Rotary Blade Analysis (MRF) Problem Intro/ Project Work Day	Handouts, Fluent Tutorials Intro_16.0_Appendix_Moving_Zones	√
11-Nov 13-Nov	Multiphase Flow Analysis (VOF Continued) Fluent Modeling 9: Multiphase Flow Analysis, VOF Analysis, (Inkjets, Fuel Injectors, Heating Coffee Cup)	Chp. 8, Fluent Tutorials Intro_16.0_Appendix_Multiphase	√
18-Nov 20-Nov	Combustion Using Species, PDF Table Generation, Energy Equation and Radiation Fluent Modeling 10, Fluent vs. Stoich Eqns, Mass Flow Calcs, & Adiabatic Flame Temperature Calcs	Fluent Tutorials Intro_Combustion_15.0_L02-Non-Premixed	
25-Nov 27-Nov	Simulations using LES modelling with STAR CCM. Fluent Modeling for Airfoil	STAR-CCM Tutorial for Airfoil	√
2-Dec 4-Dec	Project Presentations Project Presentations		
9-Dec 11-Dec	Review & Course Critique 7:45-10:00pm Final Exam		

* Last day to drop a class is Sept. 3rd. ** Last day to add a class is Sept. 10th.***In-class assignment will count as part of your homework grade.