

**San José State University**  
**Department of Mechanical Engineering**  
**ME 271 Computational Fluid Dynamics for ME (Applications)**  
**Section 01, #23738, Spring 2023**

**Instructor:**Dr. ErnestM.Thurlow

**Office Location:** Eng 401 or Eng 213 (Computer Lab)

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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/82033514025?pwd=TGFVNWtnMnE0dDVGNDZm1VWnIRQT09>

**Mtg ID: 820 3351 4025, Password: 029883**

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

**Class Zoom:** <https://sjsu.zoom.us/j/83015424370?pwd=cmEybHBmaFR5SUZaSmFEMVpDYzF4dz09>

**Mtg ID: 830 1542 4370, Password: 000895**

**Classrooms:**ENGR 401>>>ENGR 213 (Computer Lab)

**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](http://www.sjsu.edu/at/ec/canvas/student_resources/index.html)

ME271 CANVAS Website: [SP23: 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 2022" by John E. Matsson, SDC Publications, 2022

## Additional Texts/Readings

**Text 2.** "Heat and Mass Transfer , A Practical Approach" 5th 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 deadlines can be found on the [current academic calendar](#) web page located at

[http://www.sjsu.edu/academic\\_programs/calendars/academic\\_calendar/](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. The [University’s Academic Integrity policy](http://www.sjsu.edu/senate/S07-2.htm), located at <http://www.sjsu.edu/senate/S07-2.htm>, requires you 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 website](http://www.sa.sjsu.edu/judicial_affairs/index.html) is available at [http://www.sa.sjsu.edu/judicial\\_affairs/index.html](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](http://www.drc.sjsu.edu/) (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 1<sup>st</sup> floor of Clark Hall and on the 2<sup>nd</sup> floor of the Student Union. Additional computer labshare 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 2023, Section 1

Date	Topic	Introduction to ANSYS Fluent, Handouts, Online Tutorials	HW due
24-Jan 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 2-Feb	Fluent Modeling 1, Introduction to Model Setup Requirements/SpaceClaim(Take Detailed Notes!) Fluent Modeling 1, Introduction to SpaceClaim and Options	Handouts(SpaceClaim) SimCafe, Flat Plate Boundary Layer(w/ SClaim)	
7-Feb*	Fluent Modeling 1, Flat Plate Flow Analysis (Fluent vs Blasius Soln Analytical Analysis) (*Last Day to Drop Class is Feb 8)	SimCafe, Flat Plate Theory & Cornell SimCafe w/ SpaceClaim (Flat Plate Flow) (2-D)	
9-Feb	Fluent Modeling 1, Flat Plate Flow	SimCafe, Flat Plate Theory & Cornell SimCafe (Flat Plate Flow) (2-D)	
14-Feb**	CFD Post Analysis, Flat Plate Flow	SimCafe, Flat Plate Theory & Cornell SimCafe (Flat Plate Flow) (2-D)	
16-Feb	CFD Post Analysis, Flat Plate Flow	SimCafe, Flat Plate Theory & Cornell SimCafe (Flat Plate Flow) (2-D)	
21-Feb	Fluent Modeling 2, Pipe or Channel Flow + 3D Modelling Setup in SpaceClaim, Hmwk#1 Due	SimCafe, Channel Pipe Flow (2-D) Axisymmetric Flow Fluent-Intro_16.0_L03_BoundaryConditions, Hmwk#1 Due	√
23-Feb	Fluent Modeling 2, Pipe or Channel Flow + 3D Modelling Setup in SpaceClaim,	SimCafe, Channel Pipe Flow (2-D)	
28-Feb	EADT Icepak Setup, Hmwk#2 Due	EADT Icepak Lecture Notes and Videos	
2-Mar	EADT Icepak Setup	EADT, Icepak Lecture Notes and Videos, Hmwk#2 Due	√
7-Mar	EADT Icepak, Fans and Vents Setup with Simple Block Heat Transfer, Hmwk#3 Due	Handouts and Fans & Vents Handouts	√
9-Mar	EADT Icepak, Fans and Vents Setup with Simple Block Heat Transfer	Handouts and Fans & Vents Handouts	
14-Mar	EADT Icepak, JEDEC Board Natural Convection, SpaceClaim Geometry Setup Hmwk#4 Due	EADT Model Build and SpaceClaim Handouts	√
16-Mar	Turbulence Modeling, k- $\epsilon$ , 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	<i>Spring Recess- No Class:</i>		
30-Mar	<i>Spring Recess- No Class:</i>		
4-April	EADT Icepak, JEDEC Board Natural Convection, Meshing and B.C. Setup, Chip Package Modelling	Handouts Fluent-Intro_16.0_L08_HeatTransfer.pdf	
6-April	EADT Icepak, JEDEC Board Natural Convection, Fluent Modelling and Analysis	Handouts & Fluent-Intro_16.0_L08_HeatTransfer.pdf	
11-April	Fluid Flow Around Ahmed Auto, Geometry Setup in SpaceClaim	Textbook <b>Chp. ,</b>	
13-April	Fluid Flow Around Ahmed Auto, Meshing	Textbook <b>Chp. ,</b>	
18-April	Fluid Flow Around Ahmed Auto, Fluent Setup and CFD Post, Hmwk#5 Due	Textbook <b>Chp. ,</b>	√
20-April	Airfoil Problem, 2-D, SpaceClaim Setup	Textbook <b>Chp. 4</b> & Cornell SimCafe	
25-April	Airfoil Problem, 2-D, Meshing Setup and $\alpha$ Change for Meshing	Textbook <b>Chp. 4</b> & Cornell SimCafe	
27-April	Airfoil Problem, 2-D, Fluent Setup, and Analysis	Textbook <b>Chp. 4</b> & Cornell SimCafe	
2-May	Rocket Problem: Compressible, 3D Flow, SpaceClaim, Hmwk#6 Due	Textbook Chp. 13	√
4-May	Rocket Problem: Compressible Flow, Meshing and Fluent Setup	Textbook Chp. 13	
9-May	Project Presentations		
11-May	Project Presentations, Hmwk#7 Due		√
16-May	Review & Course Critique		
23-May	Monday, 7:45-10:00pm Final Exam		

\* Last day to drop a class is Feb. 7<sup>th</sup>. \*\* Last day to add a class is Feb 14<sup>th</sup>.\*\*\*In-class assignment will count as part of your homework grade.

