

<b>Semester</b>	Spring 2024
<b>Course ID</b>	Technical Elective
<b>Course Title</b>	Application of Finite Element Analysis (FEA) for Mechanical Design
<b>Instructor</b>	Professor Ping C. Sui, Ph.D. Office: 4-222 E-mail: ping.sui@scupi.cn
<b>Teaching Assistant</b>	Yiwei Cheng E-mail: 2020141520173@stu.scu.edu.cn
<b>Office Hours</b>	Wednesday 13:00-17:00 Thursday 13:00-17:00
<b>Lecture Time</b>	Wednesday 8:15-11:00
<b>Lecture Room</b>	Zone 3-105
<b>Prerequisites</b>	Engr 0135 Statics and Mechanics of Materials 1 Engr 0145 Statics and Mechanics of Materials 2 ME1028 Mechanical Design 1 (Recommended)
<b>References</b>	Daryl L. Logan (2012) A First Course in the Finite Element Method. Cengage Learning, 5 <sup>th</sup> Edition.  ANSYS Workbench User's Guide ( <a href="https://ansyshelp.ansys.com/account/secured?returnurl=/Views/Secured/corp/v201/en/wb2_help/wb2_help.html%23wb2_help">https://ansyshelp.ansys.com/account/secured?returnurl=/Views/Secured/corp/v201/en/wb2_help/wb2_help.html%23wb2_help</a> )  ANSYS Mechanical User's Guide ( <a href="https://ansyshelp.ansys.com/account/secured?returnurl=/Views/Secured/corp/v201/en/wb_sim/ds_Home.html">https://ansyshelp.ansys.com/account/secured?returnurl=/Views/Secured/corp/v201/en/wb_sim/ds_Home.html</a> )  ANSYS Element Reference ( <a href="https://ansyshelp.ansys.com/account/secured?returnurl=/Views/Secured/corp/v201/en/ans_elem/Hlp_E_LIBRARY.html">https://ansyshelp.ansys.com/account/secured?returnurl=/Views/Secured/corp/v201/en/ans_elem/Hlp_E_LIBRARY.html</a> )
<b>Course Description</b>	This course is a 3-credit hour class to apply ANSYSTM finite element analysis (FEA) in mechanical engineering analysis.
<b>Course Objective</b>	Provide students the knowledge of applying finite element analysis (FEA) technique in structural analysis of mechanical components.  Train students to develop the technical rigor and professional discipline of using FEA to assess the failure risks of a mechanical component.
<b>Course Outcome</b>	Students will develop the following technical skills: <ul style="list-style-type: none"> <li>● hands-on training of using ANSYSTM Mechanical for structural analysis,</li> <li>● discussions of validity of the developed FEA models, and</li> <li>● interpretation of FEA analysis results, and</li> <li>● risk assessment against presumed failure modes.</li> </ul>

Week	Date	Course Outline	In-Class Exercise/Workshop	Homework/Assignment
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1	Feb 28	00. Course Introduction		
2	Mar 06	01. Discrete Model for Finite Element Analysis 02. Introduction of ANSYS Workbench (WB)	WS.01 Uniaxial Tensile Test	Reading Assignment 01 Reading Assignment 02 Lab Assignment 01
3	Mar 13	02. Introduction of ANSYS Workbench (WB)	WS.01 Uniaxial Tensile Test	Lab Assignment 02
4	Mar 20	03. ANSYS WB Mechanical Basics	WS.02 Rectangular Beam	Lab Assignment 03
5	Mar 27	03. ANSYS WB Mechanical Basics (Reaction Probe for Force, Moment) 03B. Mirror Symmetry, Axial Symmetry	WS.03 Half-Model of Tensile Specimen In-Class Exercise 02 (Axisymmetry Practice)	Lab Assignment 04 Compression Member
6	<b>Apr 03</b> <b>(Holiday)</b> <b>TBD</b>	04. General Preprocessing/Post-processing 03A. Failure Assessment	WS04A Named Selection BCs WS04B Coordinate System (Radial Deformation) WS04C Coordinate System (Inclined Force) WS.04D Construct Geometry (Surface)	Lab Assignment 05 Triangular Plate
7	Apr 10	<b>Section Exam 01</b>		
8	Apr 17	05. Mesh Control in ANSYS Mechanical	WS05A Flat Plate with Circular Hole 0501 Hex/Tet Mesh Control	Lab Assignment 06 Mesh Control
9	Apr 24	06. Mesh Evaluation, Error Estimation and Convergence Check	WS.06A Arm Mesh WS.06C Fillet Stress Concentration	Lab Assignment 07
10	May 01	06. Error Estimation and Stress Singularity	0601 2D Triangular Plate Simulation 0602 2D Simulation (Stress Concentration)	Lab Assignment 07
11	May 08	LN07 Line Modeling for Beam Analysis	Workshop WS.07A	Lab Assignment 08
12	May 15	LN08 Line Modeling for Truss Analysis <b>Final Project Proposal Due</b>	1001 2D Truss Analysis	Lab Assignment 09
13	May 22	<b>Section Exam 02</b>		
14	May 29	08. Remote Displacement and Force	0901 Cantilever Beam	Lab Assignment 10

			0801 Remote Force Behavior Control 0802 Beam Bending + Axial Tension	
15	Jun 05	09. Remote Displacement and Force 10. Connection Modeling Using Contacts	WS.09C Beam Analysis Using Remote BCs WS.10A Rod-Cylinder Contact	Lab Assignment 11
16	Jun 12	10. Connection Modeling Using Contacts 13. Modal Analysis	1101 Bearing-Pin Contact Analysis 1102 Press-Fit Cylinders	Lab Assignment 12
17	Jun 19	<b>Section Exam 03</b>		
18	Jun 26	No Class		

In-Class Workshops	Hands-on practices assigned to students in class to promote discussions and keep students in-sync with course material during lecturing
Homework	Problem sets will be distributed each week after the class. Each problem set is designed to build upon the material covered in the preceding lectures and recitations. Homework assigned in a particular class is due at 8 AM on the day of the next class period, unless otherwise posted. <b>Late HW will not be accepted.</b>
Exams	Three section exams given throughout the semester, which will be in-class and hands-on type of testing to benchmark individual's proficiency in conducting a mechanical analysis using ANSYS Mechanical. All section exams will be comprehensive. <u>No make-up will be given for the missing exam.</u> Exams missed due to unpredictable events will be dealt with on a case-by-case basis.
Final Project	Each student will select a mechanical system of their own interest and work independently to conduct structural analysis using the learned ANSYS knowledge. Each student will submit a brief proposal to introduce the modeled system as well as to outline their project objective, technical approach and expected outcome. Tentative proposal deadline: <b>May 15, 2024.</b> Final project will be graded per technical challenges of the modeled problem, modeling skills, analysis details, and final report quality.
Grades	Homework & Lab Assignments: 30% Section Exams: 50% Final Project: 20% <b>No make-up exam for the course</b>  Letter grades will be assigned per following SCU scales:

附件：等级成绩和百分成绩、绩点对照表

字母等级	A	A-	B+	B	B-	C+	C	C-	D+	D	F
中文等级	优秀		良好		中等		合格			不合格	
百分制	100-90	89-85	84-80	79-76	75-73	72-70	69-66	65-63	62-61	60	<60
绩点	4	3.7	3.3	3	2.7	2.3	2	1.7	1.3	1	0

Class Attendance

Students are expected to attend every class period.  
Early is on time, on time is late. As a courtesy to your fellow classmates, be punctual and arrive no later than the class starting time.

Academic Honesty

All of us are equally responsible for ensuring a fair and positive learning environment. Students are permitted to discuss homework assignments together but should do their own work when preparing a problem solution.  
All exams are to be completed without unauthorized assistance. Any student caught cheating on an assignment or exam will receive disciplinary action, up to and including receiving a grade of "F" for the course.