



El Camino College
COURSE OUTLINE OF RECORD – Official

Subject:	ENGR
Course Number:	24
Descriptive Title:	Strength of Materials
Division:	Mathematical Sciences
Department:	Pre-Engineering
Course Disciplines:	Pre-Engineering
Catalog Description:	This course is a study of stresses, strains and deformations associated with axial, torsional and flexural loading of bars, shafts and beams, as well as pressure loading of thin-walled pressure vessels. The course also covers stress and strain transformation, Mohr's Circle, ductile and brittle failure theories, and the buckling of columns. Statically indeterminate systems are also studied.
Prerequisite:	Engineering 9 with a minimum grade of C
Co-requisite:	
Recommended Preparation:	
Enrollment Limitation:	
Hours Lecture (per week):	3
Hours Laboratory (per week):	0
Outside Study Hours:	6
Total Course Hours:	54
Course Units:	3
Grading Method:	Letter Grade only
Credit Status:	Credit, degree applicable
Transfer CSU:	Yes
Effective Date:	
Transfer UC:	Yes
Effective Date:	pending
General Education ECC:	
Term:	
Other:	
CSU GE:	
Term:	
Other:	
IGETC:	
Term:	
Other:	

Student Learning Outcomes:	Upon completion of the course, students should be able to: 1. Determine the internal and external forces and stresses applied on each structural member, under various loading conditions. 2. Determine the state of stress and strain at a point and transform along various planes.
Course Objectives:	1. Given a loading condition on a structural system, determine the forces (torques and/or moments) applied on each structural member of a system, and the internal forces and couples at internal sections. 2. Given the forces (torques/moments) applied to structural members, identify the applicable theory, and apply the appropriate equations to calculate the internal stresses, strains and/or displacements, 3. Perform coordinate transformations of the state of stress and strain at a point, including using Mohr's Circle. 4. Determine if a structural system meets its design specifications, and/or determine how the system will fail, given or having calculated the stresses, strains and displacements.
Major Topics:	I. Review of Statics/Equilibrium/Factor of Safety II. Stress and Strain A. Normal Stress/Strain Curves, Young's Modulus, Poisson's Ratio, Energy Density B. Shear Stress/Strain Curves, Shear Modulus, Shear Energy Density C. Plane Stress and Plane Strain D. General 3-D Stress-Strain relationships (optional) III. Axial Members A. Members with constant internal force/area/material B. Members with varying (discontinuous/continuous) internal force/area C. Displacement Methods to determine movement of a point D. Energy Methods E. Statically Indeterminate Systems (optional) IV. Pressure Vessels (Thin-walled) V. Torsion Members A. Members with constant internal force/area/material B. Members with varying (discontinuous/continuous) internal force/area C. Displacement Methods to determine movement of a point D. Statically Indeterminate Systems (optional) VI. Beams A. Shear and Moment Diagrams B. Bending Stress C. Beam Displacement D. Shear Stress E. Shear Flow F. Shear Center (optional) G. Statically Indeterminate Systems (optional) VII. Combined Loads and Stresses VIII. Stress Transformation A. Transformation Equations B. Principal Stresses/Maximum Shear Stress C. Mohr's Circle D. Strain Transformation (optional)

	IX. Failure Criteria
Total Lecture Hours:	54
Total Laboratory Hours:	0
Total Hours:	54
Primary Method of Evaluation:	2) Problem solving demonstrations (computational or non-computational)
Typical Assignment Using Primary Method of Evaluation:	A 500-mm long, 16 mm diameter rod made of a homogenous, isotropic material is observed to increase in length by 33 micro-meter, and to decrease in diameter by 2.4 micrometers when subjected to axial 12-kN load. Determine the modulus of elasticity and Poisson's ratio of the material.
Critical Thinking Assignment 1:	A state of plane stress consists of a tensile stress of 8 ksi exerted on vertical surfaces, and of unknown shearing stresses. Determine a. The magnitude of the shearing stress for the which the largest normal stress is 10ksi. b. The corresponding maximum shearing stress
Critical Thinking Assignment 2:	For a uniform beam AB with the distributed load, determine the reaction at A. Also, derive the elastic curve and the slope at A (note that the beam is statically indeterminate to the first degree)
Other Evaluation Methods:	
If Other:	
Instructional Methods:	Demonstration, Lab, Lecture, Discussion, Multimedia presentations
If other:	
Work Outside of Class:	Problem solving activity
If Other:	
Up-To-Date Representative Texts:	Mechanics of Materials, Beer Ferdinand, John T Dewolf and Mazurek, 8th edition, 2020
Alternative Texts:	Mechanics of Materials, 11th edition Published by Pearson (July 6, 2022) © 2023
Required Supplementary Readings:	
Other Required Materials:	
Requisite	Prerequisite
Category	sequential
Requisite course:	ENGR-9
Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s).	Apply appropriate equations to perform necessary calculations. ENGR 9 - Solve equilibrium problems in two and three dimensions using algebraic and trigonometric methods. ENGR 9 - Apply the basics of vector algebra to solve equilibrium problems in two and three dimensions.

	ENGR 9 - Convert a system of forces and moments to an equivalent system at another point of a body. Determine the forces applied in a system. ENGR 9 - Determine the resultants of distributed forces and centers of gravity. ENGR 9 - Analyze forces which occur in structures and trusses where joints are held together by pins. ENGR 9 - Determine distributed forces, shear forces, and moments in beams; draw diagrams of distributed forces, shear forces, and moments.
Requisite Skill:	
Requisite Skill and Matching skill(s): Bold the requisite skill(s). if applicable	
Requisite course:	
Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s).	
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Enrollment Limitations and Category:	
Enrollment Limitations Impact:	
Course Created by:	Pavan Nagpal
Date:	09/09/2024
Original Board Approval Date:	04/28/2025
Effective Term:	FA 2026