The University of Jordan
School of Engineering
Mechanical Engineering Department

COURSE TITLE	Continuum Mechanics	COURSE CODE	0904903
LECTURER	Prof. Naser Al-Huniti	EMAIL: alhuniti@ju.edu.jo	
CREDIT HOURS	3	PRE-REQUISITE(S)	-

2025 COURSE CATALOG DESCRIPTION

Strain tensor, deformation rate, coordinate systems, strain-displacement relations, compatibility equations. Stress tensor, balance laws, stress coordinate transformation, deviatory stresses, stress and motion with large strain. Elastic solids, Navier equations, energy principles, thermodynamics of solids, finite elasticity. Newtonian fluids, constitutive equations, laws of thermodynamics, compressible, ideal and rotational flows, turbulence, boundary layer, heat transfer. Applied topics in continuum mechanics.

REFERENCES:

1. G. E. Mase and G.T. Mase, Continuum Mechanics for Engineers. CRC.
2. T. J. Chung, Continuum Mechanics. Prentice Hall.
3. A. J. M. Spencer, Continuum Mechanics. Longman.
4. G. E. Mase, Continuum Mechanics (Shaum's Outline Series). McGraw Hill.
5. Y. C. Fung, A First Course in Continuum Mechanics. Prentice Hall.
6. L. Malvern, Introduction to the Mechanics of a Continuous Medium. Prentice Hall.

COURSE OBJECTIVES:

1. A thorough understanding of tensor algebra, calculus, and transformations and the continuum concept.
2. Ability to apply principles of tensor mathematics to stress tensor, deformation, and strain tensor.
3. Ability to apply the fundamental balance laws of continuum mechanics and constitutive laws to formulate specific mathematical models.

COURSE LEARNING OUTCOMES:

At the end of the course students will be able to:

1. Deal with symbolic, indicial, and matrix notation of tensors and tensor transformations.
2. Perform stress, deformation, and strain analysis of deformable bodies.
3. Understand and apply fundamental balance laws and constitutive laws.
4. Apply the concepts of continuum mechanics to advanced cases of elasticity.

LEARNING/TEACHING METHODS:

1. Lectures
2. Web-Based Scholarly Content
3. Seminars by students

ASSIGNMENTS:

1. Problem Solving.
2. Scholarly Research and Digital Source Exploration in Focused Areas.
3. Presentations.

ASSESSMENT:

Mid-Term Exam	30%
Assignments and activities	30%
Final Exam	40%

SYLLABUS PLAN:

Week	Topic	Hrs.
1	Introduction and Basic Concepts of Continuum Mechanics	3
2	Tensors: Rank, Symbolic Notation, Index Notation	3
3	Matrix Representation of Tensors	3
4	Transformation Laws and Matrices of Cartesian Tensors	3
5	Eigenvalue Problem, Eigen Vectors	3
6	Tensor Calculus, integral theorems	3
7	Stress Principles, Stress Vector, Stress Tensor	3
8	Equilibrium Equations, Stress Transformation, Principal Stresses	3
9	Kinematics, Deformation, and Motion (Lagrangian and Eulerial descriptions).	3
10	Finite Strain Tensors, Infinitesimal Strain Tensor, Principal Strains	3
11	Stretch ratios. Velocity gradients, Rotation Tensor	3
12	Fundamental Laws of Continuum Mechanics, Continuity Equation, Linear Momentum Principle, Angular Momentum Principle	3
13	Energy Conservation, Constitutive laws	3
14	Introduction to Linear Elasticity Theory, Tensor of Elastic Coefficients	3
15	Generalized Hooke's law, Plane Stress and Plane Strain analysis, Elastostatic and Elastodynamic Problems	3
16	Final Exam	