

## COURSE INFORMATION

Course Title	<b>Continuum Mechanics 1</b>
Instructor	Dr. Ahmad Ghasemi Ghalebahman
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Office Location	Mechanical Engineering Department, Semnan University, Semnan, Iran
Duration	16-week period
Grading Policy	Midterm Exam: 35%, Final Exam: 45%, Homework: 10% Project: 10%
Textbook(s)	G. T. Mase and G. E., Mase, <b>Continuum Mechanics for Engineers</b> , 2nd Ed. A. J. M. Spencer, <b>Continuum mechanics</b> , 1st Ed. W. M. Lai, D. Rubin and E. Krempl, <b>Introduction to Continuum Mechanics</b> , 4th Ed. J. N. Reddy, <b>An Introduction to Continuum Mechanics</b> , 2nd Ed.

## COURSE OUTLINE

Topic	Week
<b>Introduction</b> Continuum Theory Contents of Continuum Mechanics Vector and matrix algebra	<b>1</b>
<b>TENSORS</b> The Indicial Notation Summation Convention Dummy and Free Indices	<b>2</b>
The Kronecker Delta The Permutation Symbol	<b>3</b>
Components of a Tensor Tensor Calculus Dyadic Product of Vectors	<b>4</b>
Orthogonal Tensors Transformations Law for Cartesian Vectors and Tensors	<b>5</b>
Eigenvalues and Eigenvectors of Tensors Principal Values and Principal Directions of Symmetric Tensors Tensor Invariants	<b>6</b>
Scalar Field and Gradient of a Scalar Function Vector Field and Gradient of a Vector Function Gradient and Divergence Curl and Laplacian	<b>7</b>
Polar Coordinates Cylindrical Coordinates Spherical Coordinates	<b>8</b>
<b>Kinematics of a Continuum</b> Motion Description of a Continuum Lagrangean (Material) and Eulerian (Spatial) Descriptions	<b>9</b>
Material Derivative and Acceleration Kinematic of a Rigid Body Infinitesimal Deformation and Infinitesimal Strain Tensor	<b>10</b>
The Rate of Deformation Tensor The Spin Tensor and the Angular Velocity Vector The Conservation Equation of Mass	<b>11</b>
The Equations of Compatibility Deformation Gradient Polar Decomposition Theorem	<b>12</b>

Stretch and Rotation Tensors	
Green's Deformation Tensor	13
Lagrangian and Eulerian Strain Tensors	
The Current and the Reference Configurations	
Necessary and Sufficient Conditions for Strain Compatibility	14
Positive Definite Symmetric Tensors	
<b>Stress Formulations</b>	
Stress Vector and Stress Tensor	15
Energy Equation	
Entropy Inequality based on Helmholtz Energy Function	
<b>Linear Elasticity</b>	
Linearly Elastic Solid	16
Isotropic and Anisotropic Constitutive Laws	
Navier Equations of Motion	