

Spring 2024

ME 315-002: Stress Analysis

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SYLLABUS – Spring 2024: ME315

Textbook: *Advanced Strength and Applied Elasticity* 4th ed., A. Ugural & S. Fenster (Prentice-Hall)

Prerequisites: Math 222, Mech 237, ME 215

| Week | Topic | Reading | Problems |
|------|--|-------------------------------------|------------------------|
| 1 | Introduction: Free body diagrams, axial stress, torsion, bending stress, shear & moment diagrams | Lecture 1 (Canvas) | Canvas |
| 2 | Equilibrium, transformation of stresses, principal stresses | 1.1 to 1.7 1.8 to 1.10 | 1, 2 8, 9 |
| 3 | Mohr's circle for stress Three-dimensional stresses | 1.11 1.12 to 1.14 | 10, 11, 23 36, 47 |
| 4 | Normal and shearing strains, strain tensor, compatibility, Transformation of strains | 2.1 to 2.4 2.5 to 2.7 | 1, 3, 5 6, 12, 14 |
| 5 | Stress-strain relations, Strain gages | 2.8 to 2.10 | 25, 28, 29 |
| | Exam No. 1 | | |
| 6 | Strain energy, St. Venant's principle | 2.11 to 2.14 | 39, 41, 46 |
| | Plane stress, Plane Strain Airy Stress Function | 3.1 to 3.4 3.5 to 3.7 | 1a, 3, 4 5, 10, 16 |
| 7 | Stress and strain in polar coordinates Stress concentration | 3.8 to 3.9 3.10 to 3.11 | 24 36 |
| 8 | Yielding /Failure Theories Comparison of Theories | 4.1 to 4.8 4.9 to 4.12 | 3, 4, 6a 20 |
| | Exam No. 2 | | |
| 9 | Axisymmetrically loaded members Shrink fit, Composite cylinders | 8.1 to 8.4 8.5 | 1, 4, 11, 13 21, 24 |
| 10 | Rotating disks | 8.6 to 8.8 | 26, 28 |
| 11 | Energy methods, Castigliano's Theorem Virtual Work, Ritz method | 10.1 to 10.4 10.7, 10.8 to 10.11 | 3, 4, 5 30, 32 |
| | Castigliano's Theorem applications | | |
| 12 | Indeterminate Structures | Lecture 14 (Canvas) | Assigned in class |
| 13 | Exam No. 3 | | |
| | | | |
| 14 | Elastic stability of columns | 11.1 to 11.6 11.7 to 11.9 | 2, 3, 5 21 |
| 15 | Final Exam | | |