ME-315-004 STRESS ANALYSIS SPRING 2024
Course Syllabus

COURSE NUMBER	**ME 315-004**
COURSE TITLE	**Stress Analysis**
COURSE STRUCTURE	(3-0-3) (lecture hr/wk - lab hr/wk – course credits)
COURSE COORDINATOR	A. D. Rosato
COURSE DESCRIPTION	This course provides the theoretical background to stress analysis in mechanical design. Topics include two-dimensional elasticity, transformation of stress and strain, plane stress and plane strain problems, axisymmetric members, buckling criteria and failure theories.
PREREQUISITE(S)	ME 215 – Engineering Materials and Processes; Mech 237 – Strength of Materials; Math 222 – Differential Equations
COREQUISITE(S)	None
REQUIRED, ELECTIVE, OR SELECTED ELECTIVE	Required
REQUIRED MATERIALS	Mechanics of Materials, R. Craig (Wiley), 3rd edition.
Materials (not Required)	Power-point lecture notes provided by instructor
COMPUTER USAGE	MS Excel; MS Word for Homework Assignments

COURSE LEARNING OUTCOMES/ EXPECTED PERFORMANCE CRETERIA**:**

Course Learning Outcomes	SOs*	Expected Performance Criteria
1 **Use** Mohr's circle to fully analyze the stress/strain state in a body	1,2	**Exam Question** (80% of the students will earn a grade of 70% or better on this question)
2. **Explain** how Mohr's circle is related to the stress transformation equations	1,2	**Homework Assignment** (80% of the students will earn a grade of 70% or better on this assignment)
3. **Solve** stress /strain eigenvalue problems	1,2	**Exam Question** (same as 1)
4. **Apply** various failure theories needed in the design process	1,2	**Exam Question** (same as 1)
5. **Explain** and describe the relationship between stress and strain tensor	1	**Homework Assignment** (same as 2)
6. **Define** plane stress/ plane strain **Explain** Airy's Stress function for 2D problems	1	**Homework Assignment** (same as 2)
7. **Develop** equations for and **solve** axisymmetric problems - plate with hole, point loads on a half-space	1	**Exam Question** (same as 1)

	8. **Solve** problems involving thick-walled cylinders, shrink-fits, and rotating disks	1,2	**Exam Question** (same as 1)
	9. **Describe** the concepts of strain energy, deformation work and explain Betti's reciprocity theorem	1	**Homework Assignment** (same as 2)
	10. **Explain** Castigliano's theorems and apply them to problems on beam deflections, and rotations	1,2	**Exam Question** (same as 1)
	11. **Apply** Castigliano's theorems to indeterminate structures	1,2	**Exam Question** (same as 1)
	12. **Explain** elastic stability related to column buckling	1,2	**Homework Assignment** (same as 2)
	13. **Solve** simple column buckling problems	1,2	**Exam Question** (same as 1)

CLASS TOPICS

1. Introduction, stress tensor; Equilibrium, transformation of stresses, principal stresses.
2. Mohr's circle for stress, Three-dimensional stresses.
3. Normal and shearing strains, strain tensor, compatibility, Transformation of strains.
4. Stress-strain relations.
5. Strain energy, St. Venant's principle.
6. Plane stress, plane strain, Airy stress function.
7. Stress & strain in polar coordinates, Stress concentration.
8. Axisymmetrically loaded members, Shrink fit, composite cylinders, rotating disks.
9. Theories of Failure.
10. Energy methods, Castigliano's Theorem, Virtual Work.
11. Elastic Stability of Columns.

STUDENT OUTCOMES (SCALE: 1-3)

1	2	3	4	5	6	7
3	3	-	-	-	-	-

3 – Strongly supported 2 – Supported 1 – Minimally supported

* Student Outcomes