AE 7772: Fundamentals of Fracture Mechanics

Credit Hours:	3-0-3
Prerequisites:	ME 3201 or MSE 3005 or equivalent
Catalog Description:	Advanced study of failure of structural materials under load, mechanics of fracture, and microscopic and macroscopic aspects of the fracture of engineering materials. Crosslisted with ME, CEE, CHE, and MSE 7772.
Textbooks:	T.L. Anderson, *Fracture Mechanics: Fundamentals and Applications*, 2nd Edition, CRC Press, 1994
Goals:	To provide an introduction to the analytical techniques and applications of fracture mechanics, with emphasis on cracks in linear elastic materials.

Topics:

- Linear Elastic Analysis
- Fundamentals of Fracture Mechanics
    - Theoretical Strength, Stress Concentrations, Crack tip fields,
    - Fracture Modes, Fracture Criteria
- Mechanisms of Fracture and Crack Growth; Cleavage Fracture, Ductile Fracture
- Elastic Crack Tip Fields
    - Airy Stress Function
    - Complex variable method
- Weight Function Analysis
- Fracture Criteria For Elastic Brittle Fracture
- Griffith Criterion
- Crack Tip Plastic Zone (Small Scale Yielding)
    - Irwin Correction, Dugdale Approach, Plastic Zone Shape based on K
- Energetics
    - Energy Release Rate, J-Integral
- Plane Strain Fracture Toughness
- Plane Stress and Transitional Behavior
    - The R-Curve
    - The Thickness Effect
- Standard Tests
- Basic Elements Of Elastic-Plastic Fracture
- HRR Fields, J-Integral and Large Scale Yielding
- Stable Crack Growth
- Applications And Special Topics

- Cracks in Anisotropic Solids
- Interface Fracture - Composites, Bonded Joints, etc.
- Stress Corrosion
- Fatigue Crack Propagation
- 3-Dimensional Cracks
- Numerical Methods

Grading scheme:

Homework	1/3
Midterm	1/3
Final	1/3