INSTRUCTOR: M. A. Meyers

TEXTS:

1. T. L. Anderson, *Fracture Mechanics*, CRC, 1991
2. J. F. Knott, *Fundamentals of Fracture Mechanics*, Butterworth, London, 1973.
3. D. Broek, *Elementary Engineering Fracture Mechanics*, Martinus Nijhoff, The Hague, Netherlands, 1982.

OUTLINE

1. Qualitative description of fracture in metals, ceramics, polymers, composites.
2. Theoretical tensile and shear strength of crystals.
3. Griffith's crack theory.
4. Stress concentration around circular and elliptical cavities; Inglis' treatment using complex variables and curvilinear coordinates.
5. Linear elastic fracture: stress singularity for anti-plane shear; Westergaard's solution to crack problem; Williams' solution.
6. Plane stress and plane strain fracture toughness; fracture toughness testing.
7. Energy release rate, analysis; R curves.
8. The **J** integral: concept, analytical development, and J_{IC} testing in practice.
9. Elasto-plastic deformation in crack propagation: Dugdale-Barrenblatt and Cottrell-Bilby-Swinden analyses.
10. Microstructural aspects of fracture: ductile and brittle fracture, the effect of second-phase particles on fracture toughness (Rice-Johnson analysis); effects of grain size, composition, strain rate.
11. Environmentally assisted fracture: hydrogen embrittlement, liquid metal embrittlement, stress-corrosion cracking.
12. Fatigue: S-N curves and ΔK vs Δa curves; Paris "law" and short crack growth. High-cycle and low-cycle fatigue.
13. Engineering aspects: failure analysis.