

## **I. Energy Release Rate**

- A. Strain Energy and Stress Intensity
- B. **J-Integral**
- C. **Finite Elements**
  - Virtual Crack Closure
  - Direct Method
- D. **Problems**
  - Calculate J-Integral
  - Calculate  $K$  from  $G$  or  $J$
  - Describe how to find  $K$  or  $G$  using a finite element method

## **II. Mixed-Mode Fracture**

- A. **Simple Elliptical Model**
- B. **Maximum Tensile Stress**
- C. **Minimum Strain Energy Density**
- D. **Maximum Energy Release Rate**
- E. **Problems**
  - Calculate crack propagation direction
  - Explain concept behind the models given

## **III. Crack Tip Plasticity**

- A. **Irwin's Model**
- B. **Dugdale's Model**
- C. **Plastic Zone Shape**
- D. **Problems**
  - Calculate plastic zone size
  - Discuss theoretical effects of crack tip plasticity

## **IV. Elastic-Plastic Fracture**

- A. **Irwin's Adjusted Stress Intensity Approach**
- B. **Resistance Curve**
- C. **J-Integral**
- D. **Crack Tip Opening Displacement**
- E. **Crack Tip Opening Angle**
- F. **Problems**
  - Find  $K_C$  using Irwin's method
  - Find  $K_C$  from a  $K_R$  curve
  - Describe how a  $K_R$  curve is determined
  - Discuss advantages and weakness of failure models