



## **MIE1303: Engineering Fracture Mechanics**

### **Mechanical and Industrial Engineering**

### **University of Toronto**

**Instructor: Professor S A Meguid**

Ph.D., P.Eng., CEng, FIMechE, FASME FEIC LTSM-AIAA, MAAM

#### **Course Description:**

This course offers graduate students an in-depth study of fracture mechanics as applied to real engineering failures. The course is divided into three main components: failure analysis using fracture mechanics concepts, diagnostics using replicas of engineering failures, and failure prevention techniques. Modes of failure, brittle fracture, linear elastic fracture mechanics (LEFM), elasto-plastic fracture mechanics (EPFM) and fatigue crack initiation and growth constitute core of this unique course. Examinations of typical fractures will constitute the diagnostics component. Design considerations, Surface treatment and different processing techniques for crack arrest will conclude the final component. The course is supported by numerous aerospace case studies.

#### **Course Content:**

- Modes of Failure.
- Brittle Fracture.
- Griffith Thermodynamic Criterion of Brittle Fracture
- Linear Elastic Fracture Mechanics (LEFM)
- Elasto-Plastic Fracture Mechanics (EPFM)
- Fatigue Crack Growth
- Diagnostics of Engineering Fractures
- Techniques in Failure Prevention
- Case Studies
- Failure Analysis Projects

#### **Outcomes of Course:**

Upon completion of the course work, students will develop:

- Fundamental understanding of fracture mechanics.

- In-depth understanding of Failure analysis of engineering components, sub- assemblies and assemblies.
- Critical assessment of crack growth and crack arrest in engineering.
- Ability to analyze and diagnose fractures.
- Substantial knowledge in failure prevention in aerospace engineering.
- Ability to apply the three learned components to enhance engineering safety.

### **Who Should Participate:**

This is a graduate level course open to Aerospace, Mechanical, Material Science, Civil, and biomedical engineering students with the appropriate prerequisite background.

### **Prerequisite:**

Solid grasp of solid mechanics, fundamentals of engineering sciences, calculus and material science.

Professor S A Meguid

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