

**Study Guide for Ph.D. Comprehensive Exam on  
“Structure and Properties of Materials”**

**Part 1 of 2: MECH 270**

Textbook: Materials Science and Engineering, An Introduction,  
*6<sup>th</sup> edition*, William D. Callister, Jr.

Sections:

Atomic Structure and Inter-atomic Bonding – 2.1-2.8  
The Structure of Crystalline Solids – 3.1-3.10, 3.12-3.14  
Lattice Defects – 4.1-4.7  
Elastic and Plastic Deformation – 6.1-6.3, 6.5-6.8  
Dislocations and Strengthening Mechanisms – 7.1-7.6, 7.8-7.13  
Polymer Structures – 14.1-14.7, 14.11-14.12  
Mechanical and Thermo-mechanical Characteristics of polymers – 15.1-  
15.3, 15.7-15.15

**Part 2 of 2: MECH 371**

Textbook: Fracture Mechanics Fundamentals and Applications,  
*2<sup>nd</sup> edition*, T.L. Anderson

Sections:

Measurements of Fracture Toughness 1.3.1-1.3.2  
Linear Elastic Fracture Mechanics 2.1-2.2, 2.3.1-2.3.2, 2.4-2.5,  
2.6.1-2.6.3, 2.7, 2.8-2.9  
Fracture Mechanisms in Metals 5.1-5.4  
Fracture Mechanisms in Ceramics 6.2