



香港科技大學
THE HONG KONG
UNIVERSITY OF SCIENCE
AND TECHNOLOGY

Division of Integrative Systems and Design

ISDN 2603
Materials, Shape and Design
(Fall 23-24)

Instructors: Prof. Mitch Li
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Course Description:

This is a course on design and materials infused with design thinking. It covers the relationship between materials and their properties that inform their use in the design of things. We take a design-focused view, expanding the design requirements into an exploration of material properties for given shapes. This will lead naturally into a deeper understanding of functional properties and structures of materials on the one hand, and deformation and failure modes of solid mechanical objects on the other. Various material families, including metals, alloys, polymers, copolymers, and composites will be studied, and a basic understanding of how shape affects mechanical performance will be introduced. In the projects, the choice of optimal materials and shapes of an object will be determined using the design thinking approach.

Course Learning Outcomes:

At the completion of the course you will be able:

1. To understand the basic functional properties of materials
2. To be able to explain the atomic and crystalline structures of materials and how it changes under stimuli
3. To quantitatively and qualitatively understand the relationship between material properties and behavior under loads
4. To understand failure modes of materials under stress
5. To apply knowledge of material properties, their relationship between stresses and strains under loads, into practical product design

Grading:

| | |
|------------------|-------------|
| Labs/Assignments | 25% |
| Quiz | 20% |
| Project | |
| Presentation | 25% |
| Report | 30% |
| | <u>55%</u> |
| | <u>100%</u> |

Late Policy: All assignment are due @ 4:59pm, They may be submitted late by no more than 48 hours (weekend and holiday included). The penalty for late submission is 50% of the score. No score will be given for submissions after 48 hours.

Course outline:

| Week | Description |
|------|---|
| 1 | Introduction to materials for design |
| 2 | Materials family tree and strategic thinking |
| 3 | Proposal presentation |
| 4 | Atomic and crystalline structures, phase diagrams |
| 5 | Mechanical properties, part 1 |
| 6 | Mechanical properties, part 2 |
| 7 | Thermal properties |
| 8 | Mid-term presentation |
| 9 | Electrical properties |
| 10 | Magnetic properties |
| 11 | Optical properties |
| 12 | Chemical properties and durability |
| 13 | Final presentation |

Reference book:

1. Materials: Engineering, Science, Processing and Design, by MF Ashby, H Shercliff, D Cebon, pub.: Butterworth-Heinemann
2. Materials for Design by Chris Lefteri, pub.: Laurence King Publishing