MECH 329
Materials for Mechanical Design

Contact Information

Professor: Dr. Mattia Bacca
Mechanical Engineering
ICICS 165
(604) 827-5076
mbacca@mech.ubc.ca
Office Hours: M 4-6 pm

TA: Nicolas Roumaldi
Materials Engineering
AMPEL 349
nicoroumaldi@gmail.com
Office Hours: F 3-5 pm

Course website: www.connect.ubc.ca

Class Format

Lectures:	MWF	11 - 12 am	Forest Sciences Centre 1221
Tutorials:	T	4 - 5 pm	MacLeod 202

The class format will be three one-hour lectures each week and one one-hour tutorial session every week. These hours may be shifted to suit the needs of the course and timeline so all hours are to remain committed to this course. Students might be expected to do some independent research of materials information in text books or online. Course lecture slides/notes shown in class may be posted either prior to or after the lectures on the course website. Lectures will contain material not covered in the suggested textbooks or on the posted material thus it is important to attend the lectures as your lectures notes will be important to your level of success in this course. Additional material presented (e.g. video and guest speaker) plus reference materials referred to and/or provided on the website (e.g. standards, guidelines assigned for reading) will also be considered “examinable” course material.

Assigned homework problems will be posted on the course website. These assignments will include problem numbers from the course textbook and/or other problems. Examples and problems worked out during class in “real-time” will not be posted on the website.

Tutorial time will be used to present example problems, show video material and other additional course material, answer student questions about the course material, and work on assignments. When additional course material (such as a lecture) will be presented during tutorial, an announcement will be provided

during the lecture prior to the tutorial or an email will be sent to course registered students.

Full solutions to “selected” homework problems in the assignments will be posted on the website, while for others, only final answers (or in some cases no answers) will be provided (e.g. such as when available through required reading). Assistance from the TA will be available during the tutorial session in addressing any questions regarding the assigned problems. The TA may also be contacted at the location listed above.

Pre-requisites

MECH 224, MECH 260, APSC 278; It is also recommended to attend/have attended MECH 360.

Learning objectives

General objectives:

1. Describe important material properties for mechanical design.
2. Describe the underlying physical mechanisms from which these properties arise.
3. Utilize the competences acquired in points 1 and 2 in order to:
    a. Identify the pertinent criteria for materials selection, given a specific problem in mechanical design, and use these criteria to select the best material.
    b. Obtain the desired properties via processing and manufacturing (chemo-thermo-mechanical treatments) and material design (hybrid materials).

Detailed objectives:

1. Describe how and why materials deform, fail and break, for each material family (metals, ceramics, glasses, polymers, composites etc.).
2. Describe how and why materials conduct heat and develop thermal expansion.
3. Describe how and why materials corrode and conduct electricity.
4. Construct the pertinent material index for a given problem of materials selection in mechanical design and select the best material for the purpose.
6. Identify possible routes do design materials to best suit the desired application. Design of composites.

Course Grading Scheme

Midterm exam: 40% (Closed book)
Final Exam: 60% (Closed book)
- Proper formula sheet will be provided during the examination.

Textbook

Suggested Text:

M.F. Ashby, *"Materials Selection in Mechanical Design",* Butterworth Heinemann.

M.F. Ashby, D.R.H. Jones, "*Engineering Materials 1: An Introduction to Properties Applications and Design",* Butterworth Heinemann.

Optional Integrative Text:

M.F. Ashby, D.R.H. Jones, "*Engineering Materials 2: An Introduction to Microstructures, Processing and Design",* Butterworth Heinemann.

Course schedule

Week	Topic
1	**Introduction to Materials; Atomic bonds**
2-5	**Properties of materials; Property charts**
6-7	**Materials selection**
8-9	**Materials processing; Welding; Alloying**
10-13	**Hybrid materials and their design**

- The syllabus is indicative, it will be updated with more details at the beginning of the course.