

CivE 265: STRUCTURE AND PROPERTIES OF MATERIALS

This course introduces 2nd year Civil Engineering students to engineering materials, their properties, the reasons for these properties, and how to select an appropriate material for a certain use. The focus is on the needs of the civil engineer, i.e., the design, rehabilitation, construction and operational aspects of civil infrastructure, buildings, soils, mining, etc.

Lectures:

Monday	CPH3385	8:30-9:30
Wednesday	CPH3385	11:30-12:30
Friday	CPH 3385	8:30-9:30 a.m.

Labs: Monday and Wednesday 1:30-4:30 pm E3-2119

Credits:

Mid-term	10%
Assignments	10%
<u>Labs:</u>	25%
Final exam:	55 %

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Text: “Construction Materials: Their Nature and Behaviour”, J.M. Illston, and P.L.J Domone
Supplemental notes, which may contain important information, will be available at the copy center for purchase or on the website for printing.

Website Please check www.civil.uwaterloo.ca/beg and follow the Building Science Student links for updates, electronic copies of some of the course handouts, etc.

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A ROUGH OUTLINE

INTRODUCTION:

- Atomic structure, elements, solids, gases, liquids, crystals, solutions, porous media
- Material classifications
- Material properties – mechanical, electrical, optical, etc.
- Defining desirable material properties for engineering
- Review of mechanical properties measurement
- Testing methods, elastic-plastic behaviour

METALS AND THEIR MECHANICAL PROPERTIES

- Classifications, manufacture and properties
- Imperfections, dislocations
- Phase transformations, heat treatment, cold working
- Fatigue and fracture, stress concentrations, S-N curve
- Steels - carbon, stainless
- Aluminum, magnesium, and other lightweight metals
- Alloys - Brass, copper, etc.

EARTH AND CEMENTS

- Classifications, manufacture and properties of earth, gypsum, lime, clay, portland cement
- Concrete properties – fresh and cured
- Concrete, plaster, earth -- mix designs and admixtures
- Plain, reinforced, prestressed concrete

ARTIFICIAL POLYMERS AND COMPOSITES

- Classification, manufacture, and properties
- Particle and fibre-reinforced plastics and concrete
- Viscoelasticity, creep, relaxation

WOOD: NATURE'S ANISOTROPIC COMPOSITE POLYMER

- Structure of wood, softwood, hardwood, age, species
- Mechanical properties of wood
- Designing with wood

DEGRADATION OF MATERIALS

- Environment -- Heat, moisture, UV
- Corrosion of metals – nature and control
- UV attack and photooxidation of organic polymers
- Rot, mold and decay
- Dissolution, chemical attack, acid rain, etc.