**University of Ottawa**
**Faculty of Engineering**
**Department of Mechanical Engineering**

# ENGINEERING MATERIALS I
## MCG 2360

**PREREQUISITE:** **-** CHM1311 "Principles of Chemistry" or equivalent.

**TIMETABLE**

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|---|---|---|---|
| **Monday** | **4:00pm to 5:30pm** | **room SITE H0104** | lecture 1 |
| **Wednesday** | **2:30pm to 4:00pm** | **room SITE H0104** | lecture 2 |

Lectures are offered every week other than the 13th & 15th of October.

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| **Thursday** | **7:00pm to 9:00pm** | **CBY B012** Discussion Group 1 and laboratory |
| **Tuesday** | **5:00pm to 7:00pm** | **MCD 121** Discussion Group 2 and laboratory |
| **Wednesday** | **8:00am to 10:00am** | **LMX 390** Discussion Group 3 and laboratory |

These time slots are reserved for both tutorials and laboratory sessions. When no laboratory takes place, there is a tutorial.
You will need to attend these Discussion groups and laboratories only once a week, according to your group number (1 or 2).

You will complete 4 laboratory assignments during the session, in teams of 3-5 students. Laboratories will take place in CBY-B206.

Laboratory sessions:
Group1:
**September 25**, **October 9**, **October 23**, **November 6**
Group2:
**September 23**, **October 7, October 21**, **November 4**
Group3:
**September 24**, **October 8, October 22**, **November 5**

There are no laboratory-related activities on October 14th, 15th and 16th.
Due dates for your reports are stated in the list of important dates, which appears in the following pages.

**SUBJECTS: LECTURES AND LABORATORY SESSIONS**

The course will cover the following: structures of engineering metals; their mechanical properties and function. Elastic and plastic deformation. Defect structures and strengthening processes. Equilibrium phase diagrams; phase transformation and heat treatments. Failure and time dependent processes in metals.

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|---|---|
| Laboratory 1: | Tensile Test |
| Laboratory 2: | Impact test on metallic materials |
| Laboratory 3: | Mechanical Properties of steels following heat treatment |
| Laboratory 4: | Precipitation hardening of aluminium alloys |

**REFERENCES AND OTHER DOCUMENTS**

Required: Materials Science and Engineering: An Introduction by W.D. Callister, ed. J. Wiley. All editions are generally equivalent. A limited number of copies are available at the reserve of the Morisset library.

Course notes in the form of PowerPoint handouts will be available for you to download for free from the course's web site at "www.weck.ca".

Students must use a log book of the usual format (22 by 28 cm). You may re-use one of your former log books. Log books are used to record initial and expected data as well as any additional information provided in the laboratory session, some calculations and any other relevant information.

**PROFESSOR AND TEACHING ASSISTANTS**

Dr. Arnaud Weck, CBY A327, 613-562-5800 #7381, aweck@uottawa.ca. You are welcome to visit my office at any time, if I am available. You are strongly encouraged to book appointments with me by email.

Teaching Assistants:

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|---|---|---|
| Group1: | Elisa Cantergiani | ecant060@uottawa.ca |
| Group2: | Leon Guo | dguo043@uottawa.ca |
| Group3: | Rubén Fernández | rfern026@uottawa.ca |

**MARKING**

| | | |
|---|---|---|
| Final (closed book exam) | | 50% |
| Midtem (closed book exam) | | 20% |
| 4 Laboratory reports | (2.5% each) | 10% |
| 5 Assignments | (every second week – 2% each) | 10% |
| 2 Quizzes | (5% each) | 10% |

***Important note*: You must obtain a minimum of 55% on the final exams to pass the course. If this condition is not fulfilled your final mark for the course will be F, regardless of the final numerical result.**

**IMPORTANT DATES**

Group 1:

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|---|---|
| **Quizz 1** | **September 24** |
| *- Assignment 1* | *October 2* |
| * Laboratory report #1 due | October 9 |
| *- Assignment 2* | *October 16* |
| **Midterm** | **October 20** |
| * Laboratory report #2 due | October 23 |
| *- Assignment 3* | *October 30* |
| * Laboratory report #3 due | November 6 |
| **Quizz 2** | **November 12** |
| *- Assignment 4* | *November 13* |
| * Laboratory report #4 due | November 20 |
| *- Assignment 5* | *November 27* |

Group 2:

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|---|---|
| **Quizz 1** | **September 24** |
| *- Assignment 1* | *September 30* |
| * Laboratory report #1 due | October 7 |
| *- Assignment 2* | *October 14* |
| **Midterm** | **October 20** |
| * Laboratory report #2 due | October 21 |
| *- Assignment 3* | *October 28* |
| * Laboratory report #3 due | November 4 |
| **Quizz 2** | **November 12** |
| *- Assignment 4* | *November 11* |
| * Laboratory report #4 due | November 18 |
| *- Assignment 5* | *November 25* |

Group 3:

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|---|---|
| **Quizz 1** | **September 24** |
| *- Assignment 1* | *October 1* |
| * Laboratory report #1 due | October 8 |
| *- Assignment 2* | *October 15* |
| **Midterm** | **October 20** |
| * Laboratory report #2 due | October 22 |
| *- Assignment 3* | *October 29* |
| * Laboratory report #3 due | November 5 |
| **Quizz 2** | **November 12** |
| *- Assignment 4* | *November 12* |
| * Laboratory report #4 due | November 19 |
| *- Assignment 5* | *November 26* |

**WEEKLY ACTIVITIES**

Week 1: **September 3**

- Lecture 1: Introduction: outline & contents, Crystal structure (atomic structure and atomic bonding, crystal structure)

Week 2: **September 8 & 10**

- Lecture 2: Crystal structure (crystallographic points, directions and planes)
- Lecture 3: Crystal structure (crystalline and non-crystalline materials)

Week 3: **September 15 & 17**
- Lecture 4: Mechanical Properties (Demand, Stress-strain, Elastic deformation)
- Lecture 5: Mechanical Properties (Plastic deformation)

Week 4: **September 22 & 24**
- Lecture 6: Mechanical Properties (Fracture Mechanics)
- Lecture 7: Mechanical Properties (Brittle and ductile fracture) **+ Quizz 1**

Week 5: **September 29 & October 1**
- Lecture 8: Mechanical Properties (Fatigue failure)
- Lecture 9: Mechanical Properties (Creep failure)

Week 6: **October 6 & October 8**
- Lecture 10: Defects and strengthening (imperfections in solids)
- Lecture 11: Defects and strengthening (dislocations)

Week 7: **October 20 & October 22**
- Lecture 12: **MIDTERM**
- Lecture 13: Defects and strengthening (strengthening mechanisms)

Week 8: **October 27 & October 29**
- Lecture 14: Defects and strengthening (recovery, recrystallization and grain growth)
- Lecture 15: Diffusion

Week 9: **November 3 & November 5**
- Lecture 16: Phase diagrams (Definitions and basic concepts)
- Lecture 17: Phase diagrams (Binary phase diagram)

Week 10: **November 10 & November 12**
- Lecture 18: Phase diagrams (The Iron-Carbon phase diagram)
- Lecture 19: Phase transformation (Basic concepts and kinetics **+ Quizz 2)**

Week 11: **November 17 & November 19**
- Lecture 20: Phase transformation (Isothermal transformation diagram)
- Lecture 21: Phase transformation (continuous cooling transformation diagram)

Week 12: **November 24 & November 26**
- Lecture 22: Phase transformation (Mechanical behaviour of Fe-C alloys)
- Lecture 23: Applications and processing of metal alloys (types of metals and fabrication)

Week 13: **December 1**
- Lecture 24: Applications and processing of metal alloys (thermal processing of metals)

## ACADEMIC FRAUD:

Regulations on academic fraud are available here:
http://web5.uottawa.ca/mcs-smc/academicintegrity/regulation.php