

MATLS 2A04 – Introduction to Materials Engineering

Course Outline

Instructors:

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Office Hours: Monday: 15:30 – 16:20 on MS Teams ([click here to join](#)).

Course Website: MATLS 2A04 has an Avenue to Learn (Avenue) website which will be used throughout the course for announcements, the dissemination of course materials, the uploading of laboratory materials, the taking of quizzes and all other course essentials.

Lectures: Monday at 12:30-13:20 and Tuesday 13:30 to 14:20 on MS Teams. [Click here to join](#).

Tutorials: T13 125 on Monday 13:30 – 15:20. Tutorials will be conducted in-person. The first tutorial will take place on September 13, 2021 and will continue for the remainder of the term. If forced to go virtual due to changes in University policy or Public Health guidelines, tutorials will be held virtually via MS Teams.

Laboratories: Labs will take place in person on a weekly basis. Most labs will take place within various facilities of the Department of Materials Science and Engineering. Students should first gather in JHE 247, where your TAs will direct you to the appropriate room for that week's lab. Some labs will involve the use of software tools. These labs will be completed remotely by accessing the UTS virtual computer lab platform. The laboratory sections are as follows:

L01 – Monday 08:30 – 11:20; L02 – Wednesday 08:30 – 11:20; L03 – Wednesday 14:30 – 17:20;
L04 – Friday 14:30 – 17:20.

Teaching Assistants:

Name	E-mail Address
Betty Huang	huangbl@mcmaster.ca
Magdalena Laurien	laurienm@mcmaster.ca
Connie Pelligra	pelligc@mcmaster.ca
Cal Siemens	siemenc@mcmaster.ca

Calendar Description:

Crystallography, phase diagrams, phase transformations, Miller indices, slip systems and the basis of plastic deformation, biomaterials, tools for materials analysis, metallography, introduction to microstructure/property relations.

Two lectures, one tutorial (two hours), one lab (three hours); first term.

Prerequisite(s): Registration in level II Materials Engineering

Learning Outcomes:

At the conclusion of MATLS 2A04, the student should be able to:

1. Relate material properties to various length scales within the material.
2. Draw common crystal structures and use Miller indices to identify specific planes and directions within these structures.
3. Identify common crystalline defects and describe the way in which they influence material properties.
4. Read binary phase diagrams and determine phase transformation products using TTT and CCT diagrams.
5. Describe the principles of X-ray diffraction and how it is used to identify phases within crystalline materials.
6. Use pole figures to describe crystallographic texture.
7. Understand the basic classes of polymers and describe common polymerization and polymer processing methods.
8. Gain experience with common sample preparation and testing methods used for metallography and mechanical testing.
9. Relate materials (micro)structure to mechanical properties

Course Topics and Lecture Schedule:

Week 1: Length scales in materials.

Week 2: Crystal structures.

Week 3: Miller indices.

Week 4: Crystalline defects.

Week 5: Ceramics and intermetallics.

Week 6: Phase diagrams.

Week 7: Phase transformations.

Week 8: Diffraction.

Week 9: Stereographic projection, texture.

Week 10: Soft Materials

Week 11: Polymers

Week 12: Case Studies.

Week 13: Review.

Professional Development and Graduate Attributes:

MATLS 2A04 is one of the cornerstone courses of the Materials Engineering curriculum and foundational course in your training as a Materials Engineer. The Learning Outcomes in MATLS 2A04 map to the Canadian Engineering Accreditation Board indicators as follows

CEAB Graduate Attribute Indicators	Learning Outcome Measurement Point
1.4 – Competence in Specialized Engineering knowledge	1 – 3, 6, 7, 9
2.1 – Demonstrates an ability to identify reasonable assumptions (including identification of uncertainties and imprecise information) that could or should be made before a solution path is proposed	1 – 6, 7, 9
2.2 – Demonstrates an ability to identify a range of suitable engineering fundamentals (including mathematical techniques) that would be potentially useful for analyzing a technical problem	2 – 6, 8, 9
5.2 – Demonstrates ability to use modern/state of the art tools	5, 8

It should be noted that indicators 2.1 and 2.2 will primarily be evaluated through on-line quizzes.

Primary Textbook:

W. D. Callister and D. G. Rethwisch, Materials Science and Engineering: An Introduction, 10th Edition, Wiley.

Other Useful Resources:

- O. Engler and V. Randle, Introduction to Texture Analysis, 2nd Edition, CRC Press.
- S. Troler-McKinstry and R. E. Newnham, Materials Engineering, Cambridge University Press.

Laboratories and Laboratory Notebooks

MATLS 2A04 laboratories (labs) will commence in the second week of classes and continue weekly throughout the term. Labs will introduce students to skills critical to the Materials Engineer and will afford the student practical experience with various tools commonly used in Materials Engineering. The labs will have a mixed format in-person within the MSE laboratories and on-line using computer tools. Labs will be posted on Avenue. The labs have been designed to allow students to complete the laboratory and answer the questions in the lab within the allocated three hour time slot.

All students will be required to purchase and use a hard-bound laboratory notebook, which can be purchased from the bookstore. The keeping of a bound notebook for laboratories and project work is a good habit for all Engineers to get into and is a critical legal requirement for the protection of intellectual property.

Course Evaluation

Quizzes (4):	32%
Labs (9):	18%
Final Exam	50%

Course quizzes will be completed on Avenue. Each quiz will comprise a selection of questions based on the lecture material with at least one question based on laboratory write-ups. The quizzes have a time limit of 90 minutes. There is a window of five (5) days during which the student can complete the quiz. Students will be allowed one re-take of the quiz during this window. If a student completes the quiz twice, the average of the two marks will be the final mark awarded for the quiz.

Students will receive participation marks (1 mark) for attending the labs sections and being a fully participatory member of their laboratory team, as evaluated by the TAs. Full marks will be awarded for participation in the post-laboratory Q&A and the completion of the questions within the laboratories. Students will hand in their laboratory notebooks to the TA upon completion of their lab questions. The TAs will return the lab notebooks the following week.

The Final Exam will take place online.

Use of the McMaster Student Absence Form

The automatic accommodation for use of the McMaster Student Absence Form (MSAF) for all course elements will be a 72 h reopening of the quiz window or a 48 h delay in the submission of laboratory notebook images to Avenue, as appropriate.

Important Notices to Students from the University Administration

Academic Integrity

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. The academic credentials you earn are rooted in principles of honesty and academic integrity. **It is your responsibility to understand what constitutes academic dishonesty**

Academic dishonesty is to knowingly acting or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at www.mcmaster.ca/academicintegrity.

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations."

Authenticity/Plagiarist Detection

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. **All submitted work is subject to normal verification that standards of academic integrity have been upheld** (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.

Courses with an On-line Element:

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

Online Proctoring:

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/ software during tests or exams. This software may be required to be installed before the test/exam begins.

Conduct Expectations:

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the [Code of Student Rights & Responsibilities](#) (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online**.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that **interfere** with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

Academic Accommodation for Students with Disabilities:

Students with disabilities who require academic accommodation must contact [Student Accessibility Services](#) (SAS) at 905-525-9140 ext. 28652 or sas.mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University's [Academic Accommodation of Students with Disabilities](#) policy.

Requests for Relief for Missed Academic Term Work:

McMaster Student Absence Form (MSAF): In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "[Requests for Relief for Missed Academic Term Work](#)".

Academic Accommodation for Religious, Indigenous or Spiritual Observances (RISO):

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office **normally within 10 working days** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

Copyright and Recording:

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

Extreme Circumstances:

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.

Written and modified by: Joseph R. McDermid and Hatem S. Zurob, August 2021