# Course Outline

## 1. COURSE INFORMATION

<table>
<thead>
<tr>
<th>Session Offered</th>
<th>Fall 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Name</td>
<td>Manufacturing Engineering</td>
</tr>
<tr>
<td>Course Code</td>
<td>MECH ENG 3C03 (cross listed MAN TECH 3MF3 and PRO TECH 4MS3)</td>
</tr>
</tbody>
</table>
| Program Name    | Bachelor of Mechanical Engineering  
|                 | Bachelor of Chemical Engineering  
|                 | Bachelor of Materials Science and Engineering  
|                 | Bachelor of Technology |
| Calendar Description | Processing of iron and steel through metal cutting, casting, rolling, forging, cold forming, heat treatment, physics based manufacturing models, residual stresses, sustainability in manufacturing |

### Instructor
- Dr. Eu-Gene Ng  
- Phone: 905 525 9140 Ext. 27916  
- E-Mail: nge@mcmaster.ca  
- Office Hours: Mondays, 11:30 to 13:30  
- Location: ETB 216

### T.A.s

## 2. COURSE SPECIFICS

### Course Description
Mathematics description of steel, aluminum, titanium and nickel based superalloys under large strain, high strain rates and elevated temperature; Plastic behavior of materials at meso-scale and micro-scale levels; Mechanics of heat treatment and phase transformation; Mechanical and thermal loading on residual stresses; Physics based models to predict shear angle, cutting forces and calculate cutting temperature; Selection of different casting process and its limitation. Introduce to metal forming processes.

### Instruction Type

<table>
<thead>
<tr>
<th>Code</th>
<th>Type</th>
<th>Hours per term</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Classroom instruction</td>
<td>36</td>
</tr>
<tr>
<td>L</td>
<td>Laboratory, workshop or fieldwork</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>Tutorial</td>
<td></td>
</tr>
<tr>
<td>DE</td>
<td>Distance education</td>
<td></td>
</tr>
</tbody>
</table>

### Total Hours
36

### Resources

<table>
<thead>
<tr>
<th>ISBN</th>
<th>Textbook Title &amp; Edition</th>
<th>Author &amp; Publisher</th>
</tr>
</thead>
</table>

### Other Supplies

### Prerequisite(s)  

### Corequisite(s)  

### Antirequisite(s)  

### Course Specific Policies
This course will be using a range of software. Students should be aware that, when they access the electronic components of this course, 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
The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor. The instructor may also use other software including: e-mail and Avenue.

All assignments must be handed in class and on schedule. All assignments must be hand written.

| Departmental Policies | Students must maintain a GPA of 4.0 on a 12 point scale to continue in the program. The use of cell phones, iPods, laptops and other personal electronic devices are prohibited from the classroom during the class time, unless the instructor makes an explicit exception. Announcements made in class or placed on Avenue are considered to have been communicated to all students including those not in class. |

### 3. **SUB TOPIC(S)**

| Week 1 [Sep 10] | - Introduction to Manufacturing Processes and Sustainability  
|                  | - Processing of Metals  
|                  |   - Introduction to physical and mechanical properties,  
|                  |   - Energy to induce elastic and plastic deformation. |
| Week 2 [Sep 17] | - Workpiece Materials under Large Strain, Elevated Temperature and High Strain Rate Deformation  
|                  |   - Effect of strain hardening, strain rate and temperature on plastic deformation,  
|                  |   - Mathematical description of thermal and strain rate plastic behavior of material. |
| Week 3 [Sep 24] | - Crystal structural of steels,  
|                  | - Calibration of empirical material models  
|                  | - Chemical Composition and Effects on Mechanical Properties |
| Week 4 [Oct 01] | - Effect of Mechanical Properties on Design and Manufacturing Processes  
|                  |   - Case study on Low carbon high strength steel for automotive applications. |
| Week 5 [Oct 08] | - Heat Treatment  
|                  |   - Full and process annealing  
|                  |   - Normalizing  
|                  |   - Spheroidizing |
| Week 6 [Oct 15] | - Reading week |
| Week 7 [Oct 22] | - **TERM TEST** |
| Week 8 [Oct 29] | - Surface Hardening of Steel  
|                  |   - Selective heating technique  
|                  |   - Altering surface chemistry  
|                  |   - Quenching Medium |
### 4. ASSESSMENT OF LEARNING

<table>
<thead>
<tr>
<th>Activity</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignments/Quizzes</td>
<td>10%</td>
</tr>
<tr>
<td>Term Test</td>
<td>40%</td>
</tr>
<tr>
<td>Project</td>
<td></td>
</tr>
<tr>
<td>Labs</td>
<td></td>
</tr>
<tr>
<td>Participation</td>
<td></td>
</tr>
<tr>
<td>Final Examination</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Course results determined on a percentage scale will be converted to an official letter grade, as indicated in the Undergraduate Calendar. The results of all courses attempted will appear on your transcript as letter grades.

### 5. LEARNING OUTCOMES

1. Competence in Mathematics applied to manufacturing process.
2. Competence in Natural Science (Friction and temperature)
3. Competence in Specialized Engineering knowledge
4. Ability to identify reasonable assumptions that could or should be made before a solution path is proposed
5. Ability to identify a range of suitable engineering fundamentals that would be potentially useful for analyzing a technical problem

6. Ability to decompose and organize a problem into manageable sub-problems

7. Ability to obtain substantiated conclusions as a result of a problem solution including recognizing the limitations of the solutions

8. Triple bottom line – an ability to design and evaluate complex open ended engineering system using a triple bottom line of sustainability dimensions: social, economic and environment

6. POLICIES

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. 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 act 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 https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/

The following illustrates only three forms of academic dishonesty:

- plagiarism, e.g. the submission of work that is not one’s own or for which other credit has been obtained.
- improper collaboration in group work.
- copying or using unauthorized aids in tests and examinations.

AUTHENTICITY / PLAGIARISM 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 OF 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.
Student Wellness Centre
On-Campus Support for Medical and Mental Health Concerns. Doctors and Counsellors available. Located in PGCL, 2nd Floor.
Mon-Fri 9AM-5PM  905-525-9140 ext. 27700
https://wellness.mcmaster.ca/contact-us/

Main St. West Urgent Care Centre
For immediate health concerns that do not require the emergency room.
690 Main St W - Mon-Sun 9AM-9PM

Emergency Rooms
For immediate, serious health concerns.
- St. Joseph’s Healthcare Hamilton
  50 Charlton Ave E
- McMaster Children’s Hospital
  Students 17 and under

Telehealth Ontario
Telehealth Ontario is a free, confidential service you can call to get health advice or information. A Registered Nurse will take your call 24 hours a day, seven days a week.
Toll-free: 1-866-797-0000  Toll-free TTY: 1-866-797-0007

Phone Lines
- Good2Talk
  Confidential helpline providing professional counselling, info and referrals for mental health, addiction, and well-being
  1-866-925-5454
- LGBT Youthline
  Confidential, non-judgemental & informed LGBTQQ2SI peer support.
  Sun-Fri. 4-9:30 PM, Text 647-694-4275

SACHA (SEXUAL ASSAULT CENTRE - HAMILTON AREA)
Confidential, anonymous 24-hour nonjudgmental telephone support for adults who have experienced sexual violence at any point in their lives; will provide accompaniment to hospital or police station for survivors wishing to seek medical attention or report; counselling services & public education
905-525-4162

Empower Me (Graduate Students)
24/7 accessible counselling services to empower you to thrive, crisis support, mental health and well-being services.
1-844-741-6389

Bounceback
CBT skills-building for mild to moderate depression and anxiety for people 15 or older. If accessed through self-referral, the client's primary care provider will be notified.
1-866-345-0224

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Indigenous Student Services
Academic & social counselling, employment aid.
LRW 1010
ext. 23788
indigenous.admin@mcmaster.ca
indigenous.mcmaster.ca

International Student Services
Advising services for international students and exchange students
GH 104
ext. 24254
iss@mcmaster.ca
iss.mcmaster.ca
Barrett Centre for Crisis Support
Provides a safe environment in the community and responds to the needs of individuals, 16 years of age or older, who experience a mental health crisis and do not require a hospital stay. Confidential and free services 24/7/365
24 Hour Crisis Line: 905-529-7878, Toll Free: 1-844-777-3571

COAST (Crisis Outreach and Support Team)
Hamilton’s crisis line is answered 24 hours a day, 7 days a week. The COAST mobile team, consisting of a mental health worker, and a police officer, will respond to crisis calls between the hours of 8 a.m. and 1 a.m. daily.
905-972-8338

Oakville Distress Centre
Distress Centre Halton provides telephone and online support to people to better cope with crisis, loneliness, and emotional stress. Also serves the Hamilton area.
905-849-4541

Assaulted Women’s Helpline
Free, anonymous and confidential telephone and TTY crisis telephone line to all women in the province of Ontario who have experienced any form of abuse. Provides crisis counselling, safety planning, emotional support, information and referrals accessible 24/7/365.

Crisis Resources in the GTA
The CAMH Distress Crisis Resources web page lists a number of phone lines, response teams and hospitals in the GTA.
https://www.camh.ca/en/health-info/crisis-resources

Food Collective Centre (FKA Mac Bread Bin)
The Food Collective Centre is a service run by students dedicated to cultivating stronger food systems in the McMaster and surrounding community. (MSU Service)
macbreadbin@msu.mcmaster.ca
https://www.msumcmaster.ca/services-directory/14-food-collective-centre

Neighbour 2 Neighbour
Food bank, community kitchen, community counselling, help with paying for utilities, and more. Hamilton Mountain.
905-574-1334  http://www.n2ncentre.com/

Office of Student Financial aid and Scholarships
Emergency funding, government funds, OSAP assistance, scholarships, work programs
GH 120
ext. 24319
https://registrar.mcmaster.ca/aid-awards/

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905-972-8338

Oakville Distress Centre
Distress Centre Halton provides telephone and online support to people to better cope with crisis, loneliness, and emotional stress. Also serves the Hamilton area.
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https://www.camh.ca/en/health-info/crisis-resources
Student Assistance Plan (Undergraduate)
Psychological counseling (offered in-person, over the phone, or over secure video) and academic-life services (legal consultation, financial consultation, life coaching, nutrition consultation and wellness resources offered virtually or in-person)
https://www.msumcmaster.ca/services-directory/36-health-and-dental-insurance/student-assistance-plan

Ombuds Office
Advice for students, staff, and faculty regarding academic and non-academic concerns.
MUSC 210
ext. 24151
ombuds@mcmaster.ca
mcmaster.ca/ombuds

SWHAT - Walk Safe Program
The Student Walk Home Attendant Team (SWHAT) is a volunteer service within the McMaster Students Union that will walk or bus with students during the evening hours 7 days a week, in all kinds of weather!
Ext. 27500
swhat@msu.mcmaster.ca

Student Support and Case Management
Student rights & responsibilities
GH 207
ext. 23845
studentconduct.mcmaster.ca

Chaplaincy Centre
Pastoral support with personal counselling and bereavement support groups.
MUSC 231
ext. 24207

McMaster Engineering Society
Support from other McMaster Engineering Students
https://www.macengsociety.ca/

MSU PEER SUPPORT SERVICES

MSU Maccess
Maccess is a service that aims to build and maintain a campus that celebrates, advocates, and ensures inclusivity in the area of disability. A central aspect to Maccess is the provision of peer support by trained volunteers with lived experiences with disability such as chronic illness, mental illness, mental health concerns, neurodivergence, and additional identities.

Student Health Education Centre
SHEC is a peer-run health promotion, education, and referral service for McMaster University students. SHEC focuses on engaging with students about health-related issues through performances, peer support, fundraisers, and events. The service offers peer support, anonymous and confidential pregnancy testing, a resource library, condoms, lubricant, and menstrual products. SHEC's space is located in MUSC 202.

Women + Gender Equity Network
WGEN is a service that caters to women, transfolk, people who identify outside the gender binary, and all survivors of sexual assault. WGEN provides a safe(r) space and resource library on campus in MUSC 204. Volunteers in the space offer peer support and the service also runs a support group for survivors of domestic and intimate partner violence.

Pride Community Centre
The Pride Community Centre is a service of the McMaster Students Union. We provide a contact point for McMaster students that may identify as gay, lesbian, bisexual, transgender, queer, and/or any of the other diverse identities that make up our community. We offer educational programming and access to resources of interest, as well as peer support and a physical space for students to meet and socialize with each other. As advocates for gender & sexual diversity, the PCC's mandate upholds that LGBTQ+ students are entitled to a safe and supportive campus, absent of homophobia and transphobia, where the expression of one's gender & sexual identity is welcomed and respected.