

**MECH ENG 2D03 FALL 2020**  
**MECHANICAL ENGINEERING DESIGN ELEMENTS**



**INSTRUCTOR:** Mr. Daniel Pinelli, M.Eng., P.Eng.  
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Office Hours: Thursday mornings, by appointment (virtual)

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Rouzbeh, Behrad [rouzbehb@mcmaster.ca](mailto:rouzbehb@mcmaster.ca)  
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Rathore, Aashit [rathoa2@mcmaster.ca](mailto:rathoa2@mcmaster.ca)  
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**LECTURES:** Thursdays 2:30 – 3:20 pm (virtual)  
2 hours of pre-recorded (asynchronous) lecture material per week  
1 hour of live (synchronous) lecture material per week (Thursdays 2:30 – 3:20 pm)

**TUTORIALS:** T01 Thursdays 11:30 am – 12:20 pm (virtual)  
T02 Fridays 11:30 am – 12:20 pm (virtual)  
T03 Mondays 11:30 am – 12:20 pm (virtual)

**MIDTERM:** Thursday, October 29, 7 – 9 pm (virtual)

**COURSE DESCRIPTION:** This course expands on the design process taught in previous courses and introduces components used in mechanical design. Using open-ended problems, students apply design concepts to complete assigned tasks related to the following concepts.

- Design synthesis
- Fundamental principles of standard design elements
- Mechanical and fluid power elements
- Component specification and optimization

**COURSE TOPICS:**

- The design process
- Gear train design
- Mechanical drives design
- Fluid power design
- Cam design
- Mechanisms, linkage design
- Joining and fastening
- Bearing design

**COURSE MATERIALS:**

**TEXT:** None. Course notes will be posted on Avenue 2 Learn, you are expected to download the notes packets and supplement with your own notes made in class.

**CALCULATOR:** The McMaster Standard Calculator is the only calculator that may be used on the test and exam.

**DRAWING INSTRUMENTS:** Your own ruler, compass, protractor, pencils will be required for assignments, test and exam.

**EMAIL POLICY:** Any emails directed to the instructor or TA should include a subject prefix of “ME 2D03”. Your email must be sent from your own McMaster University email account. Do not send any emails through Avenue. Please be brief but descriptive in your email, I will reply within 24 hours (during the week). I do not answer emails in the 24 hours prior to exams.

**NOTE:** At certain points in the course it may make good sense to modify the schedule. The instructor may modify elements of the course and will notify students accordingly (in class, on the course website).

**ONLINE COURSE MANAGEMENT:** Course management will be done through Avenue to Learn ([avenue.mcmaster.ca](http://avenue.mcmaster.ca)). Students are required to check the system daily for assignments and lecture material, grades, and posted announcements.

<b>EVALUATION:</b>	Assignments	30%
	Tutorials	10%
	Midterm Test	25%
	Final Exam	35%

**ASSIGNMENTS:** Assignments (6 in total, 5% each) will be given out one per unit and will be due 1 week after being posted. Assignments are to be submitted online via Avenue by the time specified. Grades and grading feedback will be provided electronically via Avenue once the marking is complete. Unless under special circumstances, there is no allowance for late submissions so plan your time accordingly.

**TUTORIALS:** Tutorials (10 in total, 1% each) will be run throughout the semester, one per week starting on the second week of term. Activities or quizzes will be held in the tutorial and these will be graded for completion only. The tutorials will be a key part of learning and applying the course content and your participation is strongly encouraged.

**TEST & FINAL EXAM:** One 2 hour midterm test will be held. A 3 hour final exam will be held in December (date TBD by the registrar). The final exam must be written or else a final grade of ‘F’ will be awarded with the notation Did Not Write. The standard ‘numeric to letter grade’ conversion will be used to assign the appropriate letter grade at the end of the course.

**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”. An MSAF request must be submitted to the department and the instructor notified immediately. At this point, the instructor and student will engage in a dialogue about making up the missed work. In general the preference is to extend the due date for the missed work to a mutually agreed upon later deadline. Other options will be considered under special circumstances only

The MSAF cannot be used on the midterm or final exam. If the student is unable to write the midterm or final exam during the planned time, they must engage in a dialogue with the instructor as early as possible in the term about deferring the midterm or exam to a later date. Deferral will be considered under special circumstances only.

**LEARNING OUTCOMES:** Upon successful completion of the course, the student will be expected to have demonstrated the ability to:

1. Design a novel apparatus for performing a given task by clearly detailing objective statement, idea generation, analyses and compiling a decision matrix.
2. Critique an existing commercial product using engineering design principles with specific consideration for health and safety issues, and utilize the design process to generate new concepts that address these issues.
3. Design a creative and complex device that utilizes several inventive transfers of energy in order to accomplish a simple task.
4. Determine the acceptable tolerance of a shaft and hole for a given nominal size and Engineering specification.
5. Determine the required strength of an adhesive under given loading conditions.
6. Analyze a bolted assembly and determine the maximum load the bolts are designed to withstand.
7. Design and solve a linkage system using both a mathematical and graphical approach.
8. Determine gear train variables for given input and output speed, and assess whether the gear train can withstand specified operating conditions.
9. Design a manual transmission that is to be used in a commercially available automobile.
10. Select an appropriate bearing for specified operating conditions and justify the selection.
11. Analyze a cam and follower mechanism and determine the motion characteristics of the follower (such as displacement, velocity and acceleration).
12. Select an appropriate type of drive (e.g., gears, belts, chains) for given design criteria.
13. Analyze mechanisms that provide mechanical advantage and determine the input forces necessary to perform a given task.

**MAPPING TO GRADUATE ATTRIBUTES:** This course provides the students opportunity to develop the following measures of graduate attributes:

<i>Graduate Attribute</i>	<i>Learning Outcomes</i>
<b>A01 Knowledge Base for Engineering</b>	
1.03 Competence in Engineering Fundamentals	4, 5, 6, 8, 10, 11, 12, 13
<b>A02 Problem Analysis</b>	
2.01 Demonstrates an ability to identify reasonable assumptions that could or should be made before a solution path is proposed	8, 9, 13
2.03 Obtains substantiated conclusions as a result of a problem solution including recognizing the limitations of the solutions	5, 7, 10
<b>A03 Investigation</b>	
3.02 Selects appropriate model and methods and identifies assumptions and constraints	7, 8
<b>A04 Design</b>	
4.01 Recognizes and follows an engineering design process	1
4.02 Recognizes and follows engineering design principles including appropriate consideration of environmental, social and economic aspects as well as health and safety issues	2
4.03 Proposes solutions to open-ended problems	7, 9
4.04 Employs appropriate techniques for generation of creative ideas such as brainstorming and structured inventive thinking	3

## **MCMMASTER POLICY REMINDERS:**

### 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.

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.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at [www.mcmaster.ca/academicintegrity](http://www.mcmaster.ca/academicintegrity)

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.

### Academic Accommodations:

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail [sas@mcmaster.ca](mailto:sas@mcmaster.ca). 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 requiring a RISO accommodation 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.

### 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.

## COURSE OUTLINE – APPROVED ADVISORY STATEMENTS

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### 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](http://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

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## 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.

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