MECHENG 2DA3
Mechanical Engineering Design Elements

Undergraduate Studies
Winter 2025/2026
Course Outline

CALENDAR/COURSE DESCRIPTION

This course expands on the design process taught in previous courses and introduces components used in mechanical design. This includes design synthesis, fundamental principles of standard design elements, mechanical and fluid power elements, component specification and optimization. Using open-ended problems, students apply design concepts to complete assigned tasks.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): Registration in Level III of any Mechatronics Engineering program
Antirequisite(s): MECHENG 2D03

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Mr. Brett Sicard
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Office hours: TBA

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

Ryan Gowland
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COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

http://avenue.mcmaster.ca/

Microsoft Teams

COURSE INTENDED LEARNING OUTCOMES

By the end of this course, students should be able 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. Determine the acceptable tolerance of a shaft and hole for a given nominal size and engineering specification.
4. Analyze a bolted assembly and determine the maximum load the bolts are designed to withstand.
5. Design and solve a linkage system
6. Determine gear train variables for given input and output speed and assess whether the gear train can withstand specified operating conditions.

7. Select an appropriate bearing for a specified set of operating conditions and justify the selection.
8. Analyze a cam and follower mechanism and determine the motion characteristics of the follower (such as displacement, velocity and acceleration).
9. Select an appropriate type of drive (e.g., gears, belts, chains) for given design criteria.
10. Analyze mechanisms that provide mechanical advantage and determine the input forces necessary to perform a given task

MATERIALS AND FEES

Required Texts:
None
Recommended Additional Texts:
Shigley's mechanical engineering design, 11th edition
Calculator:
Any non-programmable calculator
Other Materials:
Class notes

COURSE FORMAT AND EXPECTATIONS

The course is organized as follows:

- 3 x week lecture
  - Monday 430-530
  - Wednesday 6-7
  - Friday 430-530
- Weekly tutorial
  - Monday 6-7
  - Tuesday 6-7
- Assessments:
  - Optional In-class quizzes
  - Mid-term exam
  - Assignments
  - Tutorial exercises
  - Final exam

COURSE SCHEDULE

Date/Week	Topic	Readings
1	Introduction to design	Chapter 1
2	Failure theory	Chapter 5,6
3	Shafts and tolerances	Chapter 7, 20
4-5	Gears	Chapter 13,14,15
6	Belts and Chains	Chapter 17
7	Bearings	Chapter 11,12
8	Cam design	
9-10	Linkage design	
11	Connections (welds and fasteners)	Chapter 8,9
12	Fluid power	

ASSESSMENT

Activity	Scheme 1	Scheme 2
In-class quizzes	0%	5%
Assignments	15	15
Tutorial Activities	15	15
Midterm exam	25	25
Final Exam	45	40

Whichever marking scheme yields the student a better mark will be used to calculate the final grade. So, a student can choses not to do the quizzes if they choose to. **If a student attempts to write the quizzes outside of class and are caught, they will get zero and are forced to use scheme 2.**

Additionally, 5% of the weight of the final and midterm can be transferred depending on which test they do better on. For example, if the student does better on the midterm than the final exam, then the midterm would be worth 30% and the final 40% assuming the first scheme is used.

ACCREDITATION LEARNING OUTCOMES

The Learning Outcomes defined in this section are measured for Accreditation purposes only and will not be directly taken into consideration in determining a student's grade in the course.

Outcomes	Indicators
Competence in engineering fundamentals	4, 5, 6, 8, 10, 11, 12, 13
Demonstrates an ability to identify reasonable assumptions that could or should be made before a solution path is proposed	8, 9, 13
Obtains substantiated conclusions as a result of a problem solution including recognizing the limitations of the solutions	5, 7, 10
Selects appropriate model and methods and identifies assumptions and constraints	7, 8
Recognizes and follows an engineering design process	1
Recognizes and follows engineering design principles including appropriate consideration of environmental, social and economic aspects as well as health and safety issues	2
Proposes solutions to open-ended problems	7, 9
Employs appropriate techniques for generation of creative ideas such as brainstorming and structured inventive thinking	3

For more information on Accreditation, please visit: https://www.engineerscanada.ca

EQUITY, DIVERSITY, AND INCLUSION

Every registered student belongs in this course. Diversity of backgrounds and experiences is expected and welcome. You can expect your instructor to be respectful of this diversity in all aspects of the course, and the same is expected of you.

McMaster University is committed to creating an environment in which students of all genders, cultures, ethnicities, races, sexual orientations, abilities, and socioeconomic backgrounds have equal access to education and are welcomed and treated fairly. If you have any concerns regarding inclusion in our department, in particular if you or one of your peers is experiencing harassment or discrimination, you are encouraged to contact the Chair, Associate Chair (Undergraduate), Academic Advisor or the Equity and Inclusion Office.

MENTAL HEALTH & WELLNESS

For a list of McMaster University's resources, please refer to the Student Wellness Centre.
Talkspot is a non-crisis mental health resource specifically for students in the Faculty of Engineering.

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:
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 / 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

McMaster is committed to sustaining an inclusive and respectful community. These principles and expectations extend to online activities including electronic chat groups, video calls and other learning platforms.

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.

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.

COURSE POLICY ON MISSED WORK, EXTENSIONS, AND LATE PENALTIES

1. It is the students' responsibility to regularly check the course webpage Avenue to Learn and/or Microsoft Teams for updates and announcements.
2. Assignments can be granted up to a 6-day extension in the case of MSAFs, otherwise they can transfer the weight to the other assignments.
3. A missed midterm exam covered by an MSAF will have its weight transferred to the final exam
4. If the Midterm exam conflicts with another class, another timeslot to write the same week (either before or after) will be provided.
5. Generally late work will not be accepted.

SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK

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".

1. **Relief for missed academic work worth less than 25% of the final grade resulting from medical or personal situations lasting up to three calendar days:**

    - Use the McMaster Student Absence Form (MSAF) on-line self-reporting tool. No further documentation is required.
    - Students may submit requests for relief using the MSAF once per term.
    - An automated email will be sent to the course instructor, who will determine the appropriate relief. Students must immediately follow up with their instructors. Failure to do so may negate the opportunity for relief.
    - The MSAF cannot be used to meet a religious obligation or to celebrate an important religious holiday.
    - The MSAF cannot be used for academic work that has already been completed attempted.
    - An MSAF applies only to work that is due within the period for which the MSAF applies, i.e. the 3-day period that is specified in the MSAF; however, all work due in that period can be covered by one MSAF.
    - The MSAF cannot be used to apply for relief for any final examination or its equivalent. See *Petitions for Special Consideration* above.

2. **For medical or personal situations lasting more than three calendar days, and/or for missed academic work worth 25% or more of the final grade, and/or for any request for relief in a term where the MSAF has been used previously in that term:**

    - Students must report to their Faculty Office to discuss their situation and will be required to provide appropriate **supporting documentation**.
    - If warranted, the Faculty Office will approve the absence, and the instructor will determine appropriate relief.

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.