

**MECH ENG 2DA3 WINTER 2020**  
**MECHANICAL ENGINEERING DESIGN ELEMENTS**



**INSTRUCTOR:** Dr. Saber Mohamed, Ph.D.  
JHE 312, [tahasr@mcmaster.ca](mailto:tahasr@mcmaster.ca)  
Office hours: by email appointment.

**TAS:** Carlos Vidal [vidalc2@mcmaster.ca](mailto:vidalc2@mcmaster.ca) , Ying Yu [yuy9@mcmaster.ca](mailto:yuy9@mcmaster.ca) , Krmasha Manar [krmasham@mcmaster.ca](mailto:krmasham@mcmaster.ca)

**LECTURES:** Wednesday 7:00PM - 10:00PM BSB 119  
**TUTORIALS:** Wednesday 6:00PM - 7:00PM BSB 155 and BSB 154

**MIDTERM:** Wednesday, February 26<sup>th</sup> 7:00PM - 9:00 PM BSB 119

**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. These concepts include:

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

**COURSE TOPICS:**

Major topics covered include:

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

**COURSE MATERIALS:**

**TEXT:** 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. Bring laptops to lecture is preferred. Optional textbook: Shigley's Mechanical Engineering Design, 10th Edition

**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.

**MEASURING INSTRUMENTS:** Vernier Caliper will be required for assignments, and in-class activities.

**EMAIL POLICY:** Any emails directed to the instructor or TA should include a subject prefix of “ME 2DA3”. 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	21%	
	Tutorial Activities	14%	
	Midterm Test	24%	*so MSAF eligible
	Final Exam	41%	

**ASSIGNMENTS:** Assignments (7 in total, 3% each) will be given out one per unit and will be due 1 week after being posted. Assignments are to be submitted **INDIVIDUALLY** to the “ME 2DA3” drop box (#1) in JHE 3<sup>rd</sup> floor by the time specified. Graded assignments will be returned via the assignment return box. \*NOTE: submissions go in the **LOCKED DROP BOX**, not the return box\*

**IN CLASS ACTIVITIES:** Seven in class activities (2% each) will be run through the semester in tutorial (see Course Schedule for dates). They will be completed in groups of 3-4, which will be self-formed.

**TEST & FINAL EXAM:** One 2 hours midterm test will be held. A 2.5-hour final exam will be held in April (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”. Should a student need to use the McMaster Student Absence Form (MSAF) for an assignment or in-class activity, the value of that deliverable will be reallocated to the others within that category (e.g. if you miss an assignment, each of the others will now be worth 3.5%). If you miss the midterm, and submit an MSAF, the value of it will be added to your final exam (65%).

**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 a specified set of 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
--	---

**McMASTER 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.