MECH ENG 2D03  FALL 2017
MECHANICAL ENGINEERING DESIGN ELEMENTS

INSTRUCTOR: Dr. Cheryl Quenneville, Ph.D., P.Eng.
ETB 404, ext. 21797, quennev@mcmaster.ca
Office hours: Wednesdays 1:30-2:20pm, or by email appointment.

TAS: Philip Maldonato (maldonp@), Christina Dou (douy2@), Pietro Stolf (stolfp@),
Carlos Vidal (vidalc2@), Uttkarsh Patel (patelu18@)

LECTURES: 9:30–10:20 Tuesday, Wednesday, Friday (JHE 264)
MIDTERM: WEDNESDAY, OCTOBER 25, 2017; 6:30-8:30 PM (MDCL 1102 & MDCL 1110)

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

COURSE MATERIALS:

TEXT: Shigley’s Mechanical Engineering Design, 10th Ed, Budynas & Nisbett, McGraw-Hill Inc., 2010 (OPTIONAL). The textbook is available in the McMaster bookstore ($150), and will be used in 3E05. It can also be sold back to the bookstore under their guaranteed buy back program ($75).

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

DRAWING INSTRUMENTS: Set squares and ruler, compass, protractor, pencils will be required for assignments, midterm and final 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.

**Online Course Management:** Course management will be done through Avenue to Learn (avenue.mcmaster.ca). Students are required to check the system daily for assignments and lecture material, grades, and posted announcements.

**Team Formation:** Assignments and in-class activities will be completed in TEAMS, consisting of 3-4 students. Teams will be self-formed. In order to receive a grade, your name must be included on the title page at the time of submission.

**Evaluation:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Weightage</th>
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<tbody>
<tr>
<td>Assignments</td>
<td>20%</td>
</tr>
<tr>
<td>Tutorial Activities</td>
<td>15%</td>
</tr>
<tr>
<td>Midterm Test</td>
<td>25%</td>
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<tr>
<td>Final Exam</td>
<td>40%</td>
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**Assignments:** TEAM assignments (approx. 7 in total) will be given out one per unit, and will be due the following week (1 week after being posted). Assignments are to be submitted to the “ME 2D03” drop box in JHE 307 by the time specified. In an effort to alleviate student stress, you will be allowed to submit ONE assignment late – this assignment must be submitted directly to the instructor within 1 week of the due date.

**In Class Activities:** Approximately seven in class activities will be run through the semester in tutorial (see Course Schedule for dates). Your best five marks will count for your grade (3% each).

**Test & Final Exam:** One 2 hour midterm test will be held. A 2.5 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”. Please note these regulations have changed beginning Fall 2015. Should a student need to use the McMaster Student Absence Form (MSAF) for an assignment or midterm, there will be no supplemental offered. The value of that deliverable to your overall grade will be added to the final examination weighting.

**Remind:** I use a service called Remind (www.remind.com) to communicate with students. This allows me to send text messages to the class reminding you of deadlines, tests, or should class need to be cancelled. I do not have access to your phone number using this service, and you can unsubscribe whenever you would like.

To join, please text “join 3933a7” to 289-217-0678, or go to https://www.remind.com/join/3933a7.
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:

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

The Faculty of Engineering is concerned with ensuring an environment that is free of all adverse discrimination. If there is a problem, that cannot be resolved by discussion among the persons involved, individuals are reminded that they should contact the Department Chair, the Sexual Harassment Office or the Human Rights Consultant, as soon as possible.

Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and 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 kinds of academic dishonesty please refer to the Academic Integrity Policy, specifically Appendix 3, located at http://www.mcmaster.ca/senate/academic/ac_integrity.htm

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.

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.