ENGPHYS 2CD4
Computational Mechanics: Dynamics
Undergraduate Studies
Fall 2023
Course Outline
Current as of Fri 2023-08-25 09:48:07; see the A2L for the most up-to-date version of this document

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CALENDAR/COURSE DESCRIPTION

Dynamics topics including force, energy, and momentum, linear and angular motion, resonance and coupled oscillators, multiparticle systems, central field problems, non-inertial reference frames, planar mechanisms, generalized coordinates, and Lagrange's equations. Course topics are explored both analytically and computationally.
Three lectures, one lab (two hours); first term

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): PHYSICS 1D03 and credit or registration in MATH 2Z03. Registration in ENGPHYS 2P04 is recommended.
Antirequisite(s): None

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. Matt Minnick
BSB/B106
minnick@mcmaster.ca
ext. 24546

Office Hours:
TBA

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

See A2L for TA info

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

The primary method of communication will be
1. Avenue To Learn (A2L, http://avenue.mcmaster.ca/) news postings for announcements - make sure to set your A2L email settings so it emails these to you.
2. MS Teams ("Course Forum") for announcements, questions, etc.
3. Email for individual messages.

COURSE INTENDED LEARNING OUTCOMES

Upon successful completion of the course, you will be able to:
1. Explain a variety of core principles in dynamics, and tackle a variety of problems that apply these principles (see each topic's notes for ILOs of that topic)
2. Use a computer algebra system (Maple) to solve a variety of physics and math problems
3. Use commercial numerical methods software (FlexPDE) to solve nonlinear dynamics problems

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MATERIALS AND FEES

COMPUTER:

Students should have a laptop computer (needed for in-person practical test exercises) capable of simultaneously running FlexPDE, Maple, and Microsoft Word (Windows machines are recommended, price point of $500 or up should be fine). You will be required to use this for the in-class quizzes and lab demos.

SOFTWARE:

FlexPDE Student Version (free online), Maple (Version 15 or higher), MS Word (2007 or newer).

REFERENCE TEXTS:

-[Required] Course notes (free online via A2L)
-[Required] Engineering Mechanics: Statics & Dynamics by Hibbeler, 15th edition (same text as 2P04) → discount if you get it through the campus bookstore

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COURSE FORMAT AND EXPECTATIONS

Note: same format for 2CD4 and 2P04, just on different (but complementary) topics

The course is organized as follows
Resources:
-Lecture notes & examples (online)
-Question bank
-Select course videos explaining past versions of the notes & some practice problems (on YouTube)

To maximize your success, you should:
1. Regularly review the Teams page and A2L for new information and participate in the learning community they establish by asking (and where possible, answering) questions there,
2. Treat your computer (and classmates) with love and respect,
3. Be enthusiastic about the material, and envision wild success with your attempts to learn it,
4. Review the notes and textbook sections prior to the live lecture,
5. Show up to the live lecture on time and ready to work through the problems along with me (i.e., equipped with your computer setup to work through practice problems for the topic),
6. Study the content with your peers,
7. Aim to understand before you memorize,
8. Reflect on problems after you get the answer, and
9. Reflect on topics to summarize key points, then review and use these summaries throughout the course to build up & refine your formula sheet.

Your grades come from 3 places in the course:
1. Classroom "**quizzes**": each lecture we spend ~30 minutes discussing & solving a problem, then you'll answer a quiz question on it (e.g., do a very similar problem to part of what we talked about) in 5-10 minutes and submit a writeup of your solution on A2L along with a 5-10 minute reflection on the key

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takeaways from the topic you'd like to remember for the future, including an assessment of how well you did at this problem

    a. Answer no, maybe, or yes to the following:
        i. did you get it done (during class)?
        ii. did you do it correctly (during class)?
        iii. do you understand it (now)?
        iv. did you do it independently (during class)?
        v. did you summarize and reflect on the key points well enough that you could do it independently in the future (by now)?

    b. Each question gives you 20% for "yes", 10% for "maybe", and 0% for "no".

    c. You should update your assessment answers later (before the next class) after reflection on the question (including comparing answers with classmates). To do this, keep your original submission in the document, and add an update below it in a subheading section (see classroom quiz template on A2L) that includes your correction to the assessment, correction to your quiz solutions, and/or updates to your summary of key points. Note that questions iii and v can be improved to "yes" by work you do after class, while the other questions are fixed to how you did it during class itself.

    d. It's possible to get marks on the questions like "did you get it done", "did you do it independently" etc. even if you didn't do it correctly as long as you did a reasonable due-diligence effort at the question and wrote this up & submitted it during class.
        i. On the flip side, you can't get marks for any questions if you don't have any work to show; if you miss submitting anything during class, it's still possible to get full marks for iii and v as long as you submit a corrected response to this with your resubmit that illustrates this.

    e. There will be 34-36 quizzes throughout the term. Each one is worth up to 1%, and we'll count your best 10 quizzes towards the 10% grade item associated with these (based on your final scores for each quiz after reassessing them prior to the next class).
        i. Any quizzes that didn't make it into your top 10 will instead be added to your pool of *reweight bonus marks* (see the assessment section).

    f. Be honest with your assessments: Any instance of academic dishonesty on the quizzes, including unfairly assessing yourself (which itself includes marking an incorrect quiz answer as correct and not fixing it on the redo) will result in a score of 0 on *all* quizzes.

    g. You'll get a chance to get feedback on these during lab sessions on non-demo weeks (which can also help with cementing understanding in preparation for demos)

2. Lab **interview demos**: the course has a question bank of questions you should practice (which are the same things we tackle in the lectures and their quizzes) including interview-style concept & demo questions on them. The lab interview demo will be you showing your work on one of the questions to the TA (you won't know which one they'll ask for in advance, so prepare all of them), demo a change they request (to show you know how to modify it), and answer a couple of interview questions on it (to show you know what it means).

    a. Marks will be based on the following:
        i. 50%: did you have the requested question done and ready to show?
        ii. 20%: did you further manage to correctly demo the requested change in a reasonable amount of time that shows your mastery of the problem?
        iii. 15%: did you answer the first concept question correctly?
        iv. 15%: did you answer the second concept question correctly?

      b.   These happen every 2 weeks, with other weeks being regular practice labs where you can practice for these and work on preparing your solutions to have ready for them.

      c.   Each one is worth at most 10% of your final grade. We'll count your best 3 out of the 5 of these lab interview demos throughout the term, and any marks earned on the remaining 2 will instead be added to your pool of *reweight bonus marks* (see the assessment section).

3.   Final **exam:** closed book exam where you can bring a double-sided formula sheet; will have questions from or similar to the question bank (but modified to be doable without a computer; e.g., won't actually need you to code anything, but may include concept questions based on results of coding or in some cases syntax questions, but only where similar ones were included in the question bank).

      a.   Your formula sheet can include concepts, but shouldn't include questions & answers to question bank questions

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COURSE SCHEDULE

See A2L for a detailed course schedule.

ASSESSMENT

Assessment Item	Each	Number	Number Counted	Total
Lecture Quizzes	1%	34-36	10	**10%**
Lab Interview Demos	10%	5	3	**30%**
Final Exam	60%	1	1	**60%-RWB**
RWB	?			**RWB**
Grand Total				**100%**

Note that the MSAF policy is as follows: MSAF'd quizzes or lab interview demos reweight the grades associated with that component (if any) to the lab exam. This would only happen if you (e.g., with the help of administrative MSAFs in extreme circumstances) MSAF'd 3 or more of the Lab Interview Demos and/or 24 or more of the lecture quizzes.

Reweight Bonus (RWB):
Grades above will count only your best 3 from 5 labs (interview demo), each worth 10%
And count only your best 10 from ~34-36 lectures (quiz/reflection), each worth 1%
Any marks earned on remaining ones pool together into "excess marks"
Excess marks then transform into reweight bonus marks as follows:
RWB = 3%*sqrt(total excess marks in %)
RWB then directly replaces exam weight.
(10% RWB would mean the exam is worth 50% instead of 60% and you have a 10% weight thing you have a grade of 100% on.)

e.g., If you did all 5 lab demos and got scores of 90%, 80%, 70%, 85%, and 30% this gives you a score of avg(90%, 85%, 80%) = 85% on the 30%-weighted lab component, plus 70%*10%+30%*10% = 10% excess marks.

If your best 10 lecture quizzes average to 100%, and adding up the marks on the others times 1% weight gives 13%, then you get 13% excess marks from lecture quizzes.

Total excess marks = 10% + 13% = 23%.

RWB = 3%*sqrt(23) = 14.39%

Final exam is then worth (60%-14.39%) = 45.61%, and you have a new grade component worth 14.39% that you have 100% on added to your final grade.

Final grade is then 85%*30% (labs) + 100%*10% (lectures) + <ExamGrade>* 45.61%(exam) + 14.39%

Note that the RWB scales very slowly with increasing excess marks, so messing up or missing a few things isn't a big deal by itself, while at the same time participating at any level you can (e.g., still doing your best even on your worst days) will always earn you some marks.

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
Can solve complex nonlinear dynamics problems with the aid of computer tools	1.4 Competence in Specialized Engineering Knowledge
Reconcile computer-produced solutions with physically meaningful results	3.2 Synthesizes the results of an investigation to reach valid conclusions
Combine analytical, CAS, and numeric tools to solve challenging mechanics problems.	4.3 Develops models/prototypes; tests, evaluates, and iterates as appropriate

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.

The Department of Engineering Physics 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 Undergraduate Chair, Academic Advisor or to contact the Equity and Inclusion Office.

PHYSICAL AND MENTAL HEALTH

For a list of McMaster University's resources, please refer to the Student Wellness Centre.

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 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

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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

It is the students' responsibility to regularly check the course forum for updates and announcements. Under normal circumstances, assignment work submitted past the due date will receive a multiplicative grade deduction equal to [how late it was submitted] / [10 hours], with a maximum penalty of 100% [relative] deduction at 10 hours past the due date. Late test lab or exam lab submissions 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.
        a. Normal MSAF relief policy for this course is covered in the assessment section.
    - 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 or 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 <u>or</u> 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.