ENGPHYS 2CD4
Computational Mechanics: Dynamics
Undergraduate Studies
Fall 2025
Course Outline

Current as of Fri 2025-08-29 13:16:29; see the A2L for the most up-to-date version of this document

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

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

Office Hours:
Wednesday - 10:30 and 12:30
Friday - 12:30
Or by appointment

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") posts for questions about content or admin things anyone else might want to know about too.
3. Email for individual messages.

CLASS FORMAT

Course Dates: 3 Sep 2025 - 3 Dec 2025
Units: 4
Course Delivery Mode: All classes are in-person
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
Prerequisite(s): PHYSICS 1D03 and credit or registration in MATH 2Z03. Registration in ENGPHYS 2P04 is recommended.
Antirequisite(s): MECHENG 2Q04, 2QA4, PHYSICS 2E03

The course is scheduled as follows:

- C01: lecture MoWeFr 17:30 – 18:20 see Mosaic for location
- L01: lab Tu 14:30 – 17:20 see Mosaic for location
- L02: lab Th 14:30 – 17:20 see Mosaic for location
- L03: lab Fr 14:30 – 17:20 see Mosaic for location

Lectures will be recorded and posted shortly afterwards on A2L via echo360.

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.

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

ACCREDITATION LEARNING OUTCOMES

The Canadian Engineering Accreditation Board (CEAB) is a division of Engineers Canada and is responsible for accrediting undergraduate engineering programs across Canada. Accreditation by the CEAB ensures that the engineering programs meet a national standard of quality and cover essential educational requirements. Graduate Attributes are a set of qualities and skills that the CEAB expects engineering graduates to possess. These attributes are a benchmark for the learning outcomes of accredited engineering programs. This section lists the Graduate Attribute Indicators associated with some of the Learning Outcomes in this course.
The Graduate Attributes 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
Explain a variety of core principles in dynamics, and tackle a variety of problems that apply these principles	1.2 - Competence in Natural Sciences
Reconcile computer-produced solutions with physically meaningful results	3.2 Synthesizes the results of an investigation to reach valid conclusions
Can use CAS and FEM solvers to solve mechanics problems computationally	5.2 Successfully uses engineering tools.

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

LAB INFORMATION

Labs will alternate between support labs where TAs help you code and solve problems in the course, and interview labs where you answer questions on your lab problem writeup. Come to all labs with your computer with the course software ready to go, and have attempted at least some problems even for the practice labs. See the Assessment section for details.

Course Schedule

Week #	Date	Major Topic	Lecture #	Lecture Topic	Readings	ILOs	Lab Activity
1	Wed 3 Sep	Intro & Particle Kinematics	1	Course Intro & Basic Concepts	Outline	1. Can explain what dynamics is and what we'll learn in this course 2. Can find and explain what's in key course resources, including the schedule, outline, essential software guides for maple & FlexPDE, course notes, Hibbeler dynamics textbook, course slides, and the maple discount code. 3. Can explain the course assessment & grading scheme 4. Can explain what maple and FlexPDE are for in this course 5. Can recognize and list the "standard" steps for solving a dynamics problem 6. Can explain what to do in preparation for the next class	No Lab in Week 1
	Fri 5 Sep		2	Kinematics of a Particle	H12.1-6, Notes 1.2-1.5, 1.6	Learn to solve projectile problems in vector notation with computers, including 1. Reviewing vector notation 2. Reviewing Position, Velocity, and Acceleration, and how they're related by derivatives 3. Define scalar and vector "differential equations of motion" 4. Define kinematics vs. kinetics, and reviewing kinematic equations 5. Learning Maple's syntax for derivatives, integrals, and plotting	
2	Mon 8 Sep		3	Curvilinear Motion	H12.7, Notes 1.5.1	1. More vector notation practice 2. Learn how to take derivatives and integrals in vector form 3. Can find normal and tangential components of acceleration, and explain what each one does. 4. Can prove why centripetal acceleration is v^2/r 5. Can find position, velocity, and acceleration for circular motion 6. Can find velocity, unit tangent and normal vectors, and tangent & normal acceleration components for arbitrary motion given position vs. time 7. Can find curvature of a path given the position vs. time, and explain what it means	Practice Lab (no demo)
	Wed 10 Sep		4	Curvilinear Motion Part 2, and Constraints and relative motion	H12.9	Curvilinear Motion: 1. Can find velocity, unit tangent and normal vectors, and tangent & normal acceleration components for arbitrary motion given position vs. time 2. Can find curvature of a path given the position vs. time, and explain what it means Absolute Dependent Motion: 1. Can use constraints to relate positions, velocities, and accelerations of connected objects	

Week #	Date	Major Topic	Lecture #	Lecture Topic	Readings	ILOs	Lab Activity
	Fri 12 Sep	Particle Kinetics: Force & Acceleration	5	Kinetics of a particle - Force & Acceleration	H13.1-3, Notes 1.7	Solve Particle Kinetic problems where forces are known and constant or time-dependent, including 1. Drawing FBDs 2. Using FBDs and N2 to write differential equations of motion 3. Solve differential equations of motion (by directly integrating, or applying other tools from kinematics)	
3	Mon 15 Sep		6	Full solution of kinetic problems	13.4, Notes 2.1-2.2	Solve Particle Kinetic problems, including 1. Drawing FBDs 2. Using FBDs and N2 to write differential equations of motion 3. Solve differential equations of motion (by directly integrating, or applying other tools from kinematics) 4. Make use of plotting and fsolve in Maple to pinpoint times events happen 5. Understand complications if force is position-dependent, and how numeric methods are more resilient to this	Practice Lab 2 (no demo)
	Wed 17 Sep		7	Normal & Tangential Vectors; Central Force problems	H13.5, Notes 1.8	Solve central force problems involving circular motion and tension, including 1. Finding normal and tangential components of force & acceleration, and explaining what they do 2. Using cylindrical coordinates to more easily describe circular motion 3. Writing and using unit tangent and normal vectors	
	Fri 19 Sep		8	Central force motion & Space mechanics	Notes 1.8, 2.1 & 2.2 (H13.6-7 optional)	ILOs: Solve for trajectory of particles in general curvilinear motion impacted central forces like the Coulomb force or universal gravity, including 1. Writing Coulombic & universal gravitational forces in vector form 2. Solving differential equations of motion in vector form using FlexPDE	
4	Mon 22 Sep	Particle Kinetics: Energy & Momentum	9	Work and Energy	H14.1-4, Notes 1.9	Can find work done by and power delivered by forces in moving an object, and the change in the objects kinetic energy, including 1. Can relate power and work 2. Can explain how force direction relative to motion direction impacts work done. 3. Can find the total work done by and instantaneous & average power delivered by non-constant forces. 4. Can use total motor efficiency to relate input electrical power to output mechanical work. 5. Can distinguish between work done by a force and work done on a force. 6. Can relate total work done on an object by all forces to its change in kinetic energy	Demo Lab (L4-8)

Week #	Date	Major Topic	Lecture #	Lecture Topic	Readings	ILOs	Lab Activity
	Wed 24 Sep		10	Conservative Forces and Potential Energy	H14.5-6, Notes 1.10	Solve & analyze mechanics problems with the help of potential energy and conservation of energy, including 1. Can explain conservative forces, and relate their force and potential energy 2. Can determine what happens to work done by and on conservative and non-conservative forces 3. Can apply potential energy expressions from springs, gravity (near and far from the earth), and Coulombic force 4. Can recognize when energy methods are appropriate and apply them in those situations	
	Fri 26 Sep		11	Linear Momentum & Collisions	H15.1-3, Notes 1.11.1-3	Solve particle problems with the help of linear momentum including 1. Determine linear momentum of a system of particles 2. Determine average impulse and how it changes momentum 3. Distinguish between impulsive and non-impulsive forces 4. Write N2 in terms of momentum 5. Solve collision problems that are either elastic or perfectly inelastic	
5	Mon 29 Sep		12	Impact	H15.4, Notes 1.11.4	Solve collision problems with arbitrary elasticity, including: 1. Explaining difference between deformation and restitution impulse 2. Defining coefficient of restitution 3. Using coefficient of restitution to relate velocities of colliding objects before and after collision 4. Determining energy lost during collisions of arbitrary elasticity.	Practice lab
	Wed 1 Oct	Advanced Dynamics Problems - Rocketry and Fluidic Drag	13	Rocketry in 1D	Notes 2.3-2.5 (skim 2.4.1.1 and 2.5) (H15.10 optional)	Solve 1D rocketry problems in Maple and FlexPDE, including: 1. Distinguish between fuel exit velocity and rocket velocity 2. Determine thrust force of a rocket 3. Write expressions for mass as a function of time 4. Set up an expression for rocket acceleration vs. time, and translate into Maple & FlexPDE 5. Solve 1D rocket problems in Maple and in FlexPDE 6. Halting at maximum altitude	
	Fri 3 Oct		14	Rocketry in 2D	Notes 2.7-8 (ignoring Fd)	Solve 2D Rocketry Problems including: 1. Writing a vector expression for rocket thrust force 2. Setup and solving rocket vector acceleration vs. time in FlexPDE 3. Halting at impact with ground 4. Relating launch angle to initial velocity vector.	

Week #	Date	Major Topic	Lecture #	Lecture Topic	Readings	ILOs	Lab Activity
6	Mon 6 Oct		15	Fluidic Drag	Notes 2.6	Write Fluidic drag force and solve Fd problems in 1d, including 1. Understanding Reynolds number, drag coefficient, viscosity, air density, frontal area, and relative speed 2. Incorporating fluidic drag force into equations of motion 3. Determining terminal velocity 4. Solving the nonlinear DE for fluidic drag in FlexPDE 5. Finding work done on fluidic drag and explaining where the energy goes	Demo Lab 2 (L9-14)
	Wed 8 Oct		16	2D Rocketry with Drag	Notes 2.7-8 (with Fd)	Solve 2D rocketry problems with viscous drag, including: 1. Writing the vector drag force in 2D 2. Incorporating wind into drag force (i.e., writing vector drag force using relative velocity), and understanding its impact on rocket direction 3. Incorporating vector drag force into 2D rocketry problems 4. Compound halt conditions in FlexPDE	
	Fri 10 Oct	Vibrations	17	Undamped Natural Vibrations: Simple Harmonic Motion	Notes 3.1 (but without damping), (H22.1-2)	Simple Harmonic Motion: Solving for natural response in undamped mass-spring systems, including 1. Writing force on a system subject to a spring restoring force 2. Generating DEs of motion for natural resonance 3. IVPs, DEs, and solving them with dsolve 4. Solving linear resonance systems in FlexPDE and maple 5. Determining and explaining natural frequency, cyclical frequency, and period 6. Explaining how position, velocity, and acceleration change over a harmonic cycle 7. Explaining how kinetic and potential energy change over a harmonic cycle 8. Creating homogeneous DEs by choice of equilibrium reference point for mass-spring systems, including those impacted by gravity	
7	*Mon 13 Oct*		*Reading Week (no classes)*				
	Wed 15 Oct						
	Fri 17 Oct						

Week #	Date	Major Topic	Lecture #	Lecture Topic	Readings	ILOs	Lab Activity
8	Mon 20 Oct		18	Damped Natural Vibrations	Notes 3.1; H22.4	Solving for response in mass-spring-damper systems, including 1. Writing force from linear damping and a spring restoring force 2. Solving linear resonant systems with damping in FlexPDE, and in maple using dsolve 3. Characterizing solutions as undamped, underdamped, critically damped, and overdamped 4. Determining damped natural frequency and damping ratio 5. Determining amplitude and energy change over time in a system with damping 6. Solving in dimensionless coordinates using damping ratio and natural frequency	Practice Lab
	Wed 22 Oct		19	Forced Vibrations	Notes 3.2.1 (but not 3.2.1.1 yet) (H22.3, 5, &6)	Solving for response in forced vibration problems, including 1. Writing a harmonic force on a mass 2. Generating differential equations of motion for forced vibrations 3. Solving these DEs with maple using dsolve, and with FlexPDE 4. Interpreting solutions for forced vibrations in general terms obtained analytically 5. Recognizing and explaining the transient vs. the steady-state portion of the solution 6. Determining time for transient response to decay to a given percent of starting amplitude. 7. Determine the response amplitude and phase-shift when driven far below, at, and far above natural frequency	
	Fri 24 Oct		20	Frequency Response, Resonance, & Quality Factor	Notes 3.2.2-3.3	Can relate amplitude and phase frequency response of a linear resonant system to the systems properties, including 1. Relating a systems dimensionless characterization parameters (ω_0,ζ,Q) to its dimensioned ones (m,b,k), and rewriting DEs in either set. 2. Determining a resonant system's frequency response amplitude & phase given enough of its parameters to do so 3. Using the frequency response amplitude plot to determine system parameters 4. Recognizing and characterizing resonant systems in general from system properties	

Week #	Date	Major Topic	Lecture #	Lecture Topic	Readings	ILOs	Lab Activity
9	Mon 27 Oct		21	Mechanical Filtering: Forward-Coupled Multistage Mass-Spring Systems	Slides	Determining frequency response of forward-coupled multistage mechanical filters, including 1. Using the transfer function to quickly obtain output for arbitrary harmonic force input by putting into equivalent "amplitude at low-frequency" form, A_0 cos (ωt+φ_0), 2. Determining equivalent force from a moving support impacting just the spring and both it and the damper, 3. Setting up DEs of coupled mass-spring problems: "multi-stage mechanical filters" 4. Using transfer functions to obtain response in cases where stages aren't impacted by subsequent ones	Demo Lab 3 (L15-20)
	Wed 29 Oct		22	Coupled Oscillators	Slides	Solving and explaining problems with coupled oscillators, including 1. Simplifying oscillator systems with coupled springs & dampers when Q≫ω_r 2. Solving coupled oscillators systems with FlexPDE 3. Qualitatively interpreting impact of second mass on the first and vice versa with resonance understanding 4. Explaining out how matched frequency systems can dampen resonant responses 5. Explaining the design benefit of independent filter stages and when this is realistic	
	Fri 31 Oct		23	Recognizing and Analyzing Resonant Response in Other Systems	Slides	How to recognize & analyze resonance systems from differential equations, including 1. Determining whether a system will have a resonant response given its differential equations, and what characteristics that response will have 2. Analyzing circuit system response (given circuit system DE), and comparing to transform method of solution from a circuits class (like EP 2E04)	
10	Mon 3 Nov	Planar Kinematics	24	Planar Kinematics of a Rigid Body: Intro and Motion about a Fixed Axis	H16.1-4; Notes4.1.1-4	Can setup and solve rigid body problems in planar kinematics, including 1. Identifying planar rigid body motion and distinguishing between rectilinear or curvilinear translation, rotation about a fixed axis, and general plane motion 2. Relating the positions r_A and r_B of points on the same rigid body to determine the displacement between them r_AB = "vector from A to B" = r_(B/A) = "position of B relative to point A" 3. Determining relative velocities v_AB and accelerations a_AB of points on a rigid body in terms of displacement between them r_AB and the body's angular velocity ω	Practice Lab

Week #	Date	Major Topic	Lecture #	Lecture Topic	Readings	ILOs	Lab Activity
	Wed 5 Nov		25	PRB Kinematics 2 -Relative Velocity	H16.5 (and briefly .6), Notes 4.1.5-6	Can setup and solve for linear and angular velocity of components in mechanisms involving planar rigid body motion, including 1. Writing cartesian coordinates of a rotating element as a function of angular position. 2. Determining relative velocity of an object in general plane motion by combining rotation and translation expressions. 3. Using trig identities (including SOHCAHTOA, laws of sines & cosines, and sum of interior triangle angles = π) where helpful to determine scalar expressions for positions & velocities and relate angles in general plane motion problems. 4. Relate linear to angular velocity in rolling problems.	
	Fri 7 Nov		26	PRB Kinematics 3: Relative Acceleration	H16.7 (Notes 4.1.7)	Can setup and solve for linear and angular acceleration of components in mechanisms involving planar rigid body motion, including 1. Writing cartesian coordinates of a rotating element as a function of angular position and trig identities, then differentiating to obtain acceleration expressions. 2. Determining relative acceleration of an object in general plane motion by combining rotation and translation expressions. 3. Relate linear to angular acceleration in rolling problems.	
11	Mon 10 Nov		27	PRB Kinematics 4: Rotating Reference Frames	H16.8, Notes 4.1.8	Can solve problems in rotating frames of reference, including 1. Determining actual velocity and acceleration given apparent velocity and acceleration from the perspective of the rotating frame 2. Explaining and determining fictitious accelerations perceived from the perspective of a rotating frame 3. Calculating Coriolis force and centrifugal force in a rotating frame of reference	Demo Lab 4 (L21-26)
	Wed 12 Nov	Planar Kinetics - N2	28	PRB Kinetics 1: N2 for Rigid Body Planar Motion	H17.1-17.4 (Notes 4.2.1-4.2.4)	Can setup and solve problems in planar rigid body kinetics, including 1. Calculate net force on an object and net torque on it about a given point, 2. Determine an object's centre of mass 3. Determine an object's moment of inertia about any point, possibly using radius of gyration, 4. Applying N2 to generate equations of motion for linear and angular motion of an object by taking net torque about CoM or a fixed axis of rotation if applicable, and 5. Show why N2 for planar rigid body angular motion in general requires "kinetic moment" terms.	

Week #	Date	Major Topic	Lecture #	Lecture Topic	Readings	ILOs	Lab Activity
	Fri 14 Nov		29	PRB Kinetics 2: N2 Advanced Applications	H17.5; Notes 4.2.5	Can setup and solve advanced problems in planar rigid body kinetics, including 1. Applying N2 to generate equations of motion for linear and angular motion of an object by taking net torque about any point, including those with nonzero kinetic moment, and 2. Show why N2 for planar rigid body angular motion in general requires "kinetic moment" terms.	
	Mon 17 Nov		30	PRB Kinetics 3: Work and Energy	H18 (Notes 5.1)	Can use energy methods to solve and analyze planar rigid body mechanics problems, including 1. Finding kinetic energy of a rigid body in planar motion 2. Finding work done by a force on a rigid body 3. Finding work of a couple moment acting on a rigid body 4. Applying principle of work & energy to determine change in an objects energy 5. Using conservation of energy and potential energy to analyze mechanics problems, including determining force or moment acting on a rigid body	
12	Wed 19 Nov	Planar Kinetics - Energy, Momentum, and Lagrange's Eqns	31	PRB Kinetics 4: Impulse & Momentum	H19.1-2, Notes 5.2.1-2	Using linear and angular momentum to solve problems in PRB mechanics, including: 1. Determining linear and angular momentum about an arbitrary point for a differential mass element of a rigid body in planar motion 2. Calculating linear and angular momentum for an entire rigid body in planar motion, and expressing this in terms of CoM's velocity and velocity of the point we're finding momentum about. 3. Determining linear and angular impulse on a body 4. Using the linear and angular impulse-momentum theorems 5. Showing how to obtain N2 from the angular impulse – angular momentum theorem.	Practice Lab
	Fri 21 Nov		32	PRB Kinetics 5: Conservation of Momentum & Rolling Problems	H19.3 (Notes 5.2.3)	Solve PRB motion problems with the help of conservation of linear and angular momentum, including 1. Understanding when linear and angular momentum about specific points are conserved 2. Breaking motion into a sequence of stages and applying impulse momentum theorems 3. Strategically combining N2, work-kinetic energy theorems, and impulse-momentum theorems to PRB mechanics problems, including rolling collisions	
13	Mon 24 Nov		33	The Lagrangian Formulation			Demo Lab 5 (L27-32)
	Wed 26 Nov		34	Lagrange's Eqns with NC Forces			

Week #	Date	Major Topic	Lecture #	Lecture Topic	Readings	ILOs	Lab Activity
	Fri 28 Nov		35	Comparing Approaches for Generating Eqns of Motion			
14	Mon 1 Dec	Review	36	Course Review			
	Wed 3 Dec		37	Course Review			
	Fri 5 Dec			(No lecture - lectures are over)			

REQUIRED/OPTIONAL 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

COURSE ASSESSMENT DETAILS

Assessment Item	Each	Number	Total
Lab Interview Demos	12%	5	**60%**
Final Exam	40%	1	**40%**
Grand Total			**100%**

Note that there are 11 weeks of labs, but not all of them have an interview demo – see the schedule for details. Note that the MSAF policy is as follows: MSAF'd lab interview demos reweight the grades associated with that component (if any) to the exam.

LAB INTERVIEW DEMOS

Half of the labs (see the schedule for which ones) will be "lab interview demos" wherein you'll first prepare and submit a write-up of your work on the lecture topics from the previous 2 weeks, then answer questions about it and the topics you covered on a one-on-one interview with the TA including a part where you use your laptop computer to solve a modification problem of one of the problems live.

1. Preparing the work write-up – earning "Potential Lab Grade":
    a. Find the Lab Assignment File for that lab in A2L and download it (don't view it on A2L because avenue often doesn't show equations correctly in the web viewer; what's actually x^{2+x} might appear to be $x^2 + x$).
    b. Prepare a writeup of solutions to the problems it contains (digitally in a word doc, while also providing code where applicable)
        i. In many cases we'll tackle these problems in lecture; in those cases, you still need to prepare your own writeup; try to change the variable names slightly or the code it some way that makes it still work but forces you to think a bit while running through it, and definitely put explanations in your own words.
    c. Note: You can work with and get help from others and the TAs, but your submitted work must be your own work that you understand. If you include portions of other resources (e.g., FBDs or code from the slides that were part of the solution but not the question, FBDs or code from others that you then adapt, writeups produced by ChatGPT, etc.) then you *must* reference where you got it or we'll see it as you claiming you did that work yourself and be forced to proceed with academic dishonesty charges (these are serious – 3 strikes total across your whole university career means expulsion, so don't claim others' work as your own!).
    d. If you only complete some of the questions (or parts of a question), divide the points for that item evenly between its questions, and then the points for each question between subquestions (i.e., part a., part b., etc.), etc., and be clear what fraction of the work you're claiming to have done.
        i. Potential Lab Grade = sqrt(The total points divided by the total available points)
            1. e.g., if you do & write up questions worth 4 marks out of 8 possible marks worth of questions then your potential grade = sqrt(4/8) = 71%
            2. Note that if the TA cannot easily understand your submission because it is disorganized or otherwise not presented clearly they cannot award you the marks for it.
    e. You must submit the writeup by 11 AM on the Monday of the week the demo lab takes place in (see the deadline in the drop box on A2L). Submitting late will incur a late penalty of 8% per hour (from your potential grade prior to the sqrt), possibly reducing it to 0 if submitted 13 or more hours late. Even in extenuating circumstances we cannot accept submissions beyond this time at all because it will not leave your TA with enough time to assess your work prior to your demo.
        i. This late penalty is multiplicative with potential grade prior to the sqrt function. e.g., if you submitted a complete and clear writeup for 67% of the work the lab covered, but submitted it 5 hours late (meaning a 40% deduction), your potential grade will be sqrt(67% * (1 - 40%)) = sqrt(67%*(60%)) = 63.4% instead of the $\sqrt{67\%} = 82\%$ you would have received if you submitted it on time.
2. During the interview:
    a. During your interview, your TA will ask you several questions selected from the work you submitted:
        i. 2 simple "what does this mean?" style questions directly about your writeup. Could be referring to variables in equations, equations themselves, lines of code ("what does this do?"), figures, etc.
        ii. 1 concept question from one of the topics you submitted some work for

   iii. 1 modification question from the one of the questions that was eligible for it (forfeited if you did not submit any) – this will require you to solve a slightly different problem on the spot, which will usually require you to be able to modify & re-run your code, then interpret the result and whether it makes sense.
      1. Note that this means you must usually solve these problems using computer tools as-demonstrated in class.
  b. The TA will assign you grades on each of these questions. Average grade across all 4 (i.e., sum of grades / 4, meaning they all count even if you didn't answer some) multiplied by your *potential grade* (see above) determines your *actual lab interview grade*.
  c. The TA will make an audio recording of the interview. This will be used for quality control to help make sure all the TAs are marking you fairly, and in particular if you have a disagreement about what happened and how you were marked on it (bring any concerns with this which you cannot resolve with your TA to the attention of the Lead TA).
3. Coverage:
  a. See the Lab Assignment File for that lab.

FINAL EXAM

1. The final exam is a closed book written exam answered on paper, but does allow you to bring the McMaster Standard Calculator and a double-sided formula sheet
   a. Your formula sheet can include concepts, but shouldn't include questions & answers to question bank questions
2. The exam 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. The exam will be multiple choice, but you will need to explain your reasoning to get credit for a question (e.g., if you select the right option, but don't explain why in a way that shows you understand, you won't get full marks for it, and might get zero marks if your explanation is bad enough or missing entirely).
   b. Part marks will typically be awarded in cases where your reasoning or answer is partially but not completely correct (e.g., multi-part questions)
      i. Note that writing an equation from the topic by itself usually won't get any marks if you can't also show you know how to use it in this situation.
3. See the sample exams on A2L for an example of the exam – these are identical in format, length, difficulty, and section coverage to the real exam.

GRADING SCALE

The McMaster 12 Point Grading Scale

Grade	Equivalent Grade Point	Equivalent Percentages
A+	12	90-100
A	11	85-89
A-	10	80-84
B+	9	77-79
B	8	73-76
B-	7	70-72
C+	6	67-69
C	5	63-66
C-	4	60-62
D+	3	57-59
D	2	53-56
D-	1	50-52
F	0	0-49

COURSE POLICY ON MISSED WORK, EXTENSIONS, AND LATE PENALTIES

It is your responsibility to regularly check both the course Teams page and A2L for updates and announcements. Policies for missed and late work are explained in the Assessment section:

You must submit the writeup by the deadline of the dropbox on A2L (Mondays at 11AM). Submitting late will incur a late penalty of 8% per hour (from your potential grade prior to the sqrt), possibly reducing it to 0 if submitted 13 or more hours late (as explained in the assessment section). Even in extenuating circumstances we cannot accept submissions beyond this time at all because it will not leave your TA with enough time to assess your work prior to your demo.
*This late penalty is multiplicative with potential grade prior to the sqrt. e.g., if you submitted a complete and clear writeup for 67% of the work the lab covered, but submitted it 5 hours late, your potential grade will be sqrt(67% * (1-5 hr late * 8%/hr late)) = sqrt(67%*(60%)) = 63.4%.*

Normal MSAF relief policy for this course is covered in the assessment section: Any MSAF'd labs would be reweighted to the final exam.
Note that if you will be unable to be on campus for your interview demo, it *may* be possible to conduct your demo remotely if you contact the lead TA and your interviewing TA prior to the start of the lab period and they agree to conduct the demo remotely. This demo will require solid enough internet that allows you to have your camera on and screen share so the TA can verify that you are answering the questions yourself. Any doubt that you are doing this genuinely can risk forfeiting your grades on the interview demo, so treat the remote option as a last resort. No MSAF is required to take this option.

GENERATIVE AI

Though it's not recommended, students may freely use generative AI in this course so long as the use of generative AI is referenced and cited following citation instructions given in the syllabus. Use of generative AI outside assessment guidelines or without citation will constitute academic dishonesty. It is the student's responsibility to be clear on the expectations for citation and reference and to do so appropriately.
The reason it's not recommended is that our objectives here are to learn the physics of the problems we're tackling (the writeup of the lab file is really just there for *you* to learn the key concepts by doing it! The writeup is not the goal, it's a means to the true end of learning mechanics). For that reason, we're providing a lot of support for you with problems in class and labs, and setting up assessments that encourage you to go through the steps of solving them yourself. Remember to think about what you've done and why each step works; if you hand in code that's totally different than how we've been solving things in class because you departed substantially from the course techniques with the help of generative AI, we may not be able to follow your solution enough to grant you marks.

APPROVED ADVISORY STATEMENTS

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 and the Faculty of Engineering are 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.

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.

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

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.

ACADEMIC ADVISING

Academic Advisors are available to assist you with any problems or questions you may have. This includes course selections, changes to your enrolment, McMaster Student Absence Form (MSAF), Religious, Indigenous, or Spiritual Observances (RISO) forms, exams, taking courses at another university (for credit at McMaster), Petitions for Special Consideration, and much more. Below is the contact information for the Office of the Associate Dean (Academic) in the Faculty of Engineering:

JHE-Hatch 301
https://www.eng.mcmaster.ca/programs/academic-advising
(905) 525-9140 ext. 24646

PHYSICAL AND MENTAL HEALTH

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

REQUESTS 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". An abbreviated version is provided below.

The University recognizes that students periodically require relief from academic work due to extenuating circumstances. Students seeking relief for missed academic term work are expected to read the ***McMaster Student Absence Form Policy***. The Policy aims to manage these requests by taking into account the needs and obligations of students, instructors and administrators. It is the prerogative of the instructor of the course to determine the appropriate relief for missed term work in their course. Any concerns regarding the granting of relief should be directed to the Faculty Office.

1. **Relief for missed academic work worth less than 25% of the final grade resulting from medical or personal situations lasting up to three (3) 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 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 (3) 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.