MIE 100S – DYNAMICS

January – April 2023

Lecture schedules and locations

Section	Instructor	Start Date	Lecture times	Room
LEC0101	Pierre Sullivan pierre.sullivan@utoronto.ca MC 225	2023/01/09 2023/01/11 2023/01/12	Mon 14:00 15:00 Wed 14:00 15:00 Thu 14:00 15:00	SS2102 (Mon) WB116 (Wed) PB B150 (Thu)
LEC0102	Abbas Ali mirabbas.ali@mail.utoronto.ca MY 614	2023/01/10 2023/01/12 2023/01/13	Tue 9:00 10:00 Thu 9:00 10:00 Fri 9:00 10:00	MC252
LEC0103	Lidan You youlidan@mie.utoronto.ca MC 316	2023/01/09 2023/01/11 2023/01/13	Mon 17:00 18:00 Wed 17:00 18:00 Fri 17:00 18:00	MS 2170
LEC0104	Anthony Sinclair sinclair@mie.utoronto.ca MC 415	2023/01/10 2023/01/11 2023/01/13	Tue 16:00 17:00 Wed 16:00 17:00 Fri 16:00 17:00	GB248 (Tue) MC254 (Wed and Fri)
LEC0105		2023/01/10 2023/01/11 2023/01/13	Tue 10:00 11:00 Wed 10:00 11:00 Fri 10:00 11:00	LM162 (Tue) SS2117 (Wed) SF1101 (Fri)
LEC0106	Edmond Young edmond.young@utoronto.ca MC 313	2023/01/10 2023/01/12 2023/01/13	Tue 10:00 11:00 Thu 10:00 11:00 Fri 10:00 11:00	GB248

Final mark distribution

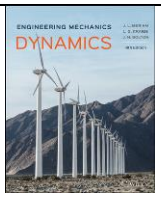
Final examination (Type D: aid sheet) Covers: All material in Course		50%
Quiz, (Type D: aid sheet) Chapter 1,2	January 31 1:00-2:15pm [EX 100 and EX 200]	15%
Midterm Test, (Type D: aid sheet) Chapters 2-5.4	March 9 6-7:30pm [EX 100 and EX 200]	30%
Online assignments		5%

Text

Engineering Mechanics: Dynamics, 9th Edition
James L. Meriam, L. G. Kraige, J. N. Bolton

ISBN: 978-1-119-39098-5

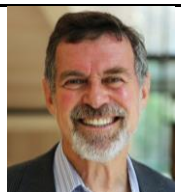
WileyPlus is the homework platform for MIE100.



To purchase access to WileyPlus – please follow this Campus Bookstore Link

Office hours

All instructors have offices in the Mechanical Engineering Building
5 King's College Road M5S 3G8

Instructor	Office hours everyday	What do I do outside of lecture?
Pierre Sullivan pierre.sullivan@utoronto.ca MC 225 	Monday 10-11 AM	I study fluid mechanics and turbulence. My focus is on aerodynamic control of low Reynolds number flows. As well, my lab designs high temperature pressure sensors and hot water distribution systems. See: http://turbulence.mie.utoronto.ca
Anthony Sinclair sinclair@mie.utoronto.ca MC 415 	Tuesday Noon - 1 PM	Non-destructive material characterization by means of ultrasound with applications to nuclear power plants, aerospace, oil/gas pipelines, protective coatings, welds, material interfaces; ultrasonic phased arrays; signal processing and image enhancement. www.mie.utoronto.ca
Lidan You youlidan@mie.utoronto.ca MC 316 	Wednesday 1-2 PM	Muscular skeletal system biomechanics. Specific focus: 1) the anti-resorptive effect of mechanical loading on bone tissue; 2) advanced microfluidics system for bone cell mechanotransduction study; and 3) the effect of mechanical loading on cancer metastasis in bone. http://cbl.mie.utoronto.ca
Edmond Young eyoung@mie.utoronto.ca MC 313 	Thursday 1-2 PM	I study microfluidics and develop microfluidic systems for biomedical applications. Focus of my lab is on “organ-on-a-chip" engineering and technology development, including microfabrication, device design and materials, with applications in lung and cancer research. See lab website at: https://ibmt.mie.utoronto.ca/
Abbas Ali mirabbas.ali@mail.utoronto.ca MY 614 	Fri 1-2 PM	My research is focused on modeling lithium-ion battery aging using electrochemical and data-based methods. Additionally, I look to determine effective methods to diagnose battery health in EV applications and ultimately support the thermo-mechanical design of battery packs. See: https://atoms.mie.utoronto.ca/abbas-ali/

Students may attend the office hours of *any* of the course instructors

Online access

Online access to WileyPlus website. The website is used for weekly assignments (as described in Online assignments).

Course Objectives

General:

- Develop a working knowledge of the basic principles of classical mechanics
- Acquire familiarity with various coordinate systems and associated vector calculus for describing the motion of particles and two-dimensional objects
- Develop skills to analyze a problem, extract and combine information given in the form of text or diagrams
- Gain familiarity with techniques for formulating and solving multi-step engineering problems, and select an appropriate solution strategy from several possible candidates.
- Build an understanding of the conceptual relationship between concepts in mechanical engineering and electrical engineering

Specific Learning Objectives from the Dynamic Concept Inventory[1]

- Different points on a rigid body have different velocities and accelerations, which vary continuously.
- If the net external force on a body is not zero, then the mass center must have an acceleration and it must be in the same direction as the force.
- Angular velocities and angular accelerations are properties of the body as a whole and can vary with time.
- Rigid bodies have both translational and rotational kinetic energy.
- The angular momentum of a rigid body involves translational and rotational components and requires using some point as a reference.
- Points on an object that is rolling without slip have velocities and acceleration that depend on the rolling without slip condition.
- In general, the total mechanical energy is not conserved during an impact.
- An object can have (a) nonzero acceleration and zero velocity or (b) nonzero velocity and no acceleration.
- The inertia of a body affects its acceleration.
- The direction of the friction force on a rolling rigid body is not related in a fixed way to the direction of rolling.
- A particle has acceleration when it is moving with a relative velocity on a rotating object.

[1] Gray, Gary L., Francesco Costanzo, Don Evans, Phillip Cornwell, Brian Self, and Jill L. Lane. "The dynamics concept inventory assessment test: A progress report and some results." In *American Society for Engineering Education Annual Conference & Exposition*. 2005.

Course outline and approximate timetable

Chapter	Topic	Lecture hours	Approximate Starting date
1, 2 • **Omit Graphical Interpretations from section 2.2,Omit 2.7**	Kinematics of Particles	8 hours	January 9th
3,4 • **Omit Power and Efficiency from Section 3.6** • **Omit 3.12, 3.13, 3.14** • **Note: Central Force Motion is covered in Prof Sullivan's video lectures in weeks 4 and 6** • **Omit 4.6 and 4.7**	Kinetics of Particles	10 hours	January 25th
5 • **Omit 5.7**	Plane Kinematics of Rigid Bodies	5 hours	February 27th
6 • **Omit Power from 6.6** • **Omit 6.7**	Plane Kinetics of Rigid Bodies	9 hours	March 9th
8 • **Omit Damped Forced Vibrations from 8.3** • **Omit 8.5**	Vibrations and Time Response	6 hours	March 30th

Exact starting date may vary among the various lecture sections.

Midterm tests and Final Examination

Midterm test 1 (Quiz): (covers chapter 1,2) January 31 (1PM), Exam Centre
Midterm test 2: (covers chapters 1-5.4 (RB Relative Velocity)) March 9 (6PM), Exam Centre
Final exam: All material listed in the course outline will be examinable.
Room assignments will be posted close to the date of each test and exam.

Calendar Course Description

This course on Newtonian mechanics considers the interactions which influence 2-D, curvilinear motion. These interactions are described in terms of the concepts of force, work, momentum and energy. Initially the focus is on the kinematics and kinetics of particles. Then, the kinematics and kinetics of systems of particles and solid bodies are examined. Finally, simple harmonic motion is discussed. The occurrence of dynamic motion in natural systems, such as planetary motion, is emphasized. Applications to engineered systems are also introduced.

Calculator

During the exam and midterm tests, students must use one of the following non-programmable calculators:

Casio FX991	Casio FX991EX	Casio FX991ES PLUS	Casio FX991MS
Sharp EL520X	Sharp EL-520W		

Additional information and updates can be found on the First-Year Office website

Email

For all emails regarding the course, start your subject with "MIE100 - ".
Example: "MIE 100 - Problems with WileyPlus"

For all administrative queries related to problems with *WileyPlus* or tutorials: email mie100-admin@mie.utoronto.ca Or try the WileyPlus Chat www.wileyplus.com/go/wpngsupport
For questions regarding technical course material, you can email your tutorial section TA's (names posted on

Quercus), or see any one of the instructors or TA's during office hours.

Quercus website

The course website is on Quercus, https://q.utoronto.ca/
Note that most information for this course will be posted on Quercus under the heading of lecture section L0101 – the posted information actually applies to ALL lecture sections of this course.
The course website will have available: contact information for your instructor and teaching assistants; some extra (not graded) problems and their solutions; midterm room assignments; details on the course outline and any announcements made in class. It will also have your midterm grades listed. Students will be responsible for checking the course website to ensure that midterm grades have been recorded accurately.

Online assignments

This course requires the completion of 10 weekly assignments. These will be accessible (and answers must be submitted) through the *WileyPlus* website. To register on WileyPlus, you need to access your course on Quercus.

At the start of the term, use the instructions on Page 8 of this handout to register for our course.

Be sure to use your proper UofT registration name and UofT email address.

Each Wednesday night at 11:59 pm, starting January 11th 2023, there will be a list of assigned problems, which must be solved and submitted on-line by the next Sunday night at 11:59 pm (see the calendar) eleven days after, e.g., the first assignment is released on January 11, 2023 and is due January 22, 2022 at 11:59pm. These problems will generate a different set of input data for each student and so copying from each other will not work, but you are encouraged to work with your friends and TAs (see tutorial information below) to fully understand the problem; this should then allow you to complete your individual calculations. You will be given up to unlimited chances (although too many efforts may result in a lockout from WileyPlus that is outside of MIE100 settings) to enter the correct answer for each problem. This should give you an opportunity to correct any small calculation errors and will be a good inspiration for thorough checking. Once the assignment is submitted, you cannot change your answers.
If you must miss an assignment for any legitimate reason, a petition and supporting documents must be submitted to **the First-Year Office**.
Link: https://undergrad.engineering.utoronto.ca/petitions/about-petitions/

Tutorials

Tutorials start on **Friday January 13th**

Section	Day of the week	Time (Start)	Time (End)	First day	Room	TA 1	TA 2
TUT0101	MO	16:00	18:00	1/16/2023	BA 1200	Kecheng Xu	Hanieh Rezaei
TUT0102	TU	15:00	17:00	1/17/2023	GB 303	Joseph Sebastian	Michael Mohan
TUT0103	TH	14:00	16:00	1/19/2023	SF 2202	Celine Xiao	Shahzeb Mirza
TUT0104	TH	12:00	14:00	1/19/2023	SF 2202	Saeed Alkatheri	Taha Sheikh
TUT0105	MO	12:00	14:00	1/16/2023	SF 3202	Matthew Butler	Khodr Jaber
TUT0106	WE	9:00	11:00	1/18/2023	GB 304	Eric Floro	Khodr Jaber
TUT0107	TH	13:00	15:00	1/19/2023	GB 304	Adnan Machado	Howard Ho
TUT0108	MO	13:00	15:00	1/16/2023	SF 2202	Mahmoud Embabi	Md Akibul Islam
TUT0109	TU	15:00	17:00	1/17/2023	SF 2202	Haleh Shahsa	Md Akibul Islam
TUT0110	TU	15:00	17:00	1/17/2023	BA 1200	Howard Ho	Matthew Butler
TUT0111	FR	13:00	15:00	1/13/2023	SF 2202	Kevin Perera	Zinan Cen
TUT0112	WE	10:00	12:00	1/18/2023	SF 2202	Joseph Sebastian	Michael Mohan

At each tutorial, an old quiz or midterm or exam question will be distributed and students will have some time to work on it alone. This is intended to give you lots of practice under exam/test-like conditions. After this initial exercise, you will be free to continue working on the problem with your classmates and the TAs will be there to

help. If there is a clarification needed for many students, a TA will give a small presentation. Halfway into the tutorial, all students should have a firm grasp of the exam question and its solution.
Thereafter, the tutorial will be a work session for your assignments. Although answers must be submitted on-line, dynamics problems are best solved with a pencil and paper. You should bring a copy of your assignment to the tutorial (or a copy of the problems you are having difficulty with) where you will be free to work with your friends and get individual help from the TA's. The print version of the assignments will be enabled on the WileyPlus website. Finally, the tutorial will serve as a time to get help with posted weekly suggested problems as well.
Please stick to your assigned tutorial section. You should get to know your TA's and desks are limited in all sections. Your TAs will provide you with their email addresses during the tutorials. These will also be posted on Quercus.

Petitions for term course work

Petitions for special consideration for term work (quiz, mid-term test, or weekly assignments) must be submitted directly to the First-Year Office. Do not submit them to your TA or instructor. (https://undergrad.engineering.utoronto.ca/petitions/about-petitions/)

Office hours

Office hours for instructors are listed on page 2. You can also e-mail TA's or instructors for guidance, although face-to-face assistance is probably a better way to give a pictorial view of a Dynamics problem. Also, try Piazza – it is a great forum to discuss course material.

Required technology

See the Recommended Technology Requirements for Remote/Online Learning from the Vice Provost, Students.

Notice of video recording and sharing

This course, including your participation, may be recorded on video and will be available to students in the course for viewing remotely.

Course videos and materials belong to your instructor, the University, and/or other source depending on the specific facts of each situation and are protected by copyright. In this course, you are permitted to view session videos and materials for your own academic use, but you should not copy, share, or use them for any other purpose without the explicit permission of the instructor.

For questions about recording and use of videos in which you appear please contact your instructor.

Students may create audio/video-recordings of the lectures for their personal use. Recordings are intended to permit lecture content review to enhance understanding of the topics presented. Audio/video-recordings are not a substitute for attending class.

Students should note that since audio/video recordings are to be permitted, they may be recorded by others during the class. Please speak to the instructor if this is a concern for you.

In accordance with the Accessibility for Ontarians with Disabilities Act, 2005, persons who have special needs will be accommodated.

Students agree to the following terms when creating audio recordings of lectures:

- Recordings are not to be distributed without the permission of the instructor via the Internet, using social media such as Facebook, peer-to-peer file sharing such as One Drive or Dropbox, or other distribution channels.
- Recordings are not to be shared with other classmates unless they are to be used in collaborative assignments, or if the instructor permits for other reasons.

Non-compliance with these terms violates an instructor's intellectual property rights and the Canadian Copyright Act. Students violating this agreement will be subject to disciplinary actions under the Code of Student Conduct.

Inclusivity Statement

You belong here. The University of Toronto commits to all students, faculty and staff that you can learn, work

and create in a welcoming, respectful and inclusive environment. In this class, we embrace the broadest range of people and encourage their diverse perspectives. This team environment is how we will innovate and improve our collective academic success. You can read the evidence for this approach here.

We expect each of us to take responsibility for the impact that our language, actions and interactions have on others. Engineering denounces discrimination, harassment and unwelcoming behaviour in all its forms. You have rights under the Ontario Human Rights Code. If you experience or witness any form of harassment or discrimination, including but not limited to, acts of racism, sexism, Islamophobia, anti-Semitism, homophobia, transphobia, ableism and ageism, please tell someone so we can intervene. Engineering takes these reports extremely seriously. You can talk to anyone you feel comfortable approaching, including your professor or TA, an academic advisor, our Assistant Dean, Diversity, Inclusion and Professionalism, the Engineering Equity Diversity & Inclusion Action Group, any staff member or a U of T Equity Office.

You are not alone. Here you can find a list of clubs and groups that support people who identify in many diverse ways. Working together, we can all achieve our full potential.

Statement on Accommodations

The University of Toronto supports accommodations for students with diverse learning needs, which may be associated with mental health conditions, learning disabilities, autism spectrum, ADHD, mobility impairments, functional/fine motor impairments, concussion or head injury, blindness and low vision, chronic health conditions, addictions, deafness and hearing loss, communication disorders and/or temporary disabilities, such as fractures and severe sprains, or recovery from an operation.

If you have a learning need requiring an accommodation the University of Toronto recommends that students register as soon as possible with Accessibility Services.

Phone: **416-978-8060**
Email: **accessibility.services@utoronto.ca**

Statement on Mental Health

As a university student, you may experience a range of health and/or mental health challenges that could result in significant barriers to achieving your personal and academic goals. Please note, the University of Toronto and the Faculty of Applied Science & Engineering offer a wide range of free and confidential services that could assist you during these times.
As a U of T Engineering student, you have an Academic Advisor (undergraduate students) or a Graduate Administrator (graduate students) who can support you by advising on personal matters that impact your academics. Other resources that you may find helpful are listed on the U of T Engineering Mental Health & Wellness webpage, and a small selection are also included here:

- Accessibility Services & the On-Location Advisor
- Graduate Engineering Council of Students' Mental Wellness Commission
- Health & Wellness and the On-Location Health & Wellness Engineering Counsellor
- Inclusion & Transition Advisor
- U of T Engineering Learning Strategist and Academic Success
- My Student Support Program (MySSP)
- Registrar's Office
- SKULE Mental Wellness
- Scholarships & Financial Aid Office & Advisor

If you find yourself feeling distressed and in need of more immediate support resources, consider reaching out to the counsellors at My Student Support Program (MySSP) or visiting the Feeling Distressed webpage.

Land Acknowledgement

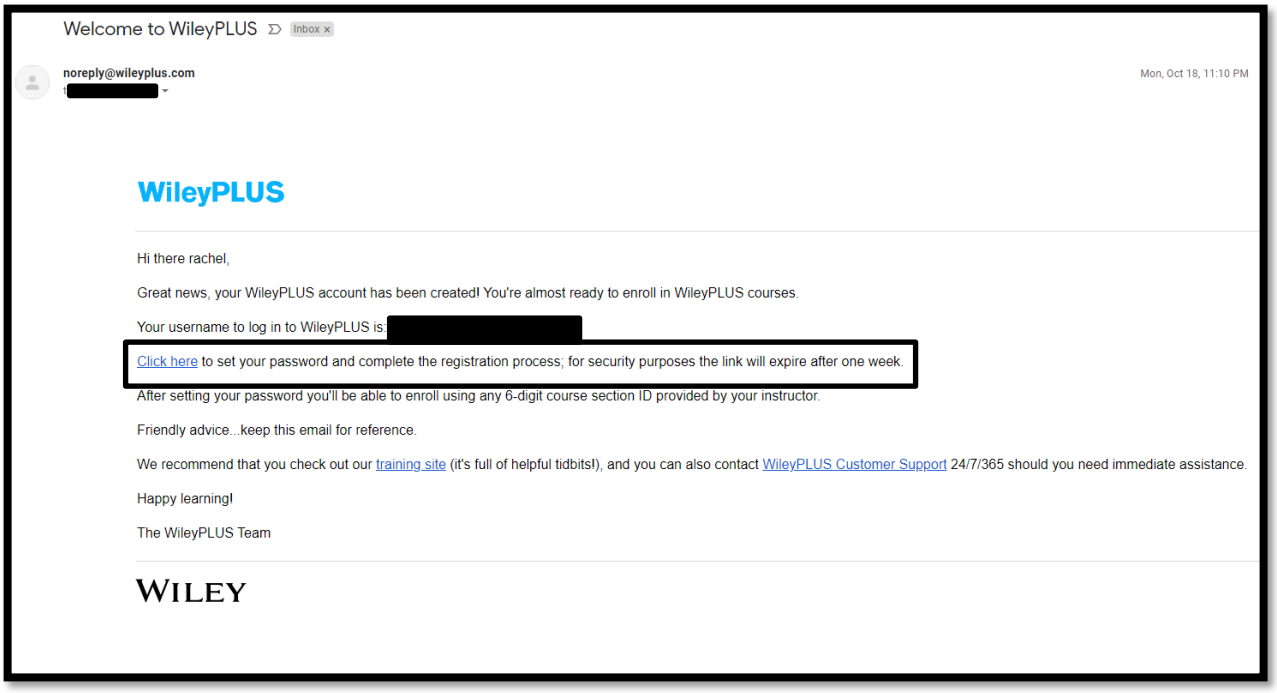
The University of Toronto operates on land that for thousands of years has been the traditional land of the Huron-Wendat, the Seneca, and most recently, the Mississauga of the Credit River. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.

WileyPlus Sign up Information

Your course section ID is B87037

*If you have already created a WileyPLUS account please skip to Step 2.

Step 1: Set your password
Your account has been created for you in WileyPLUS and you have been enrolled in your course for MIE100. Please check your University of Toronto email for an email from noreply@WileyPLUS.com
Follow the link in the email to set your password:



Step 2: Access your course section
Login at www.WileyPLUS.com/go/login with the password you have created and click on the course for MIE100. You can register for a 14-day trial or enter the access code from the bookstore once purchased.

Need Help?

Live chat support https://wpsupport.wiley.com/s

If you have taken the course previously and had purchased WileyPLUS, please contact mie100-admin@mie.utoronto.ca to extend your subscription.

To Purchase WileyPlus access from the Campus Bookstore – please follow this link

Additional information

Videos of Course Material

On YouTube, videos will be provided to summarize course material and provide some worked problems. These videos supplement course materials and will be released after the lectures are delivered.
Please see the Quercus site for the weekly releases.

Open Source Software

Computer Algebra Software:

- Smath Studio - https://en.smath.com/view/SMathStudio/summary
- Mathcad Express - https://www.ptc.com/en/products/mathcad
- SageMath: http://www.sagemath.org/

Computer Algebra Websites

- Wolfram|Alpha https://www.wolframalpha.com/
- Wolfram|Alpha Demonstration Projects https://demonstrations.wolfram.com
- Smath Studio in the cloud https://en.smath.com/cloud/

Matlab (programming) alternative

- Scilab https://www.scilab.org
- GNU Octave https://www.gnu.org/software/octave/
- Julia https://julialang.org/
- NumPy https://www.numpy.org/
- Scicos (Simulink option) http://www.scicos.org/

Mechanics Software

- Open Source Physics - https://www.compadre.org/osp/?
- Tracker – good for projectile motion https://physlets.org/tracker/

Blogs/YouTube

- Prof Sullivan - MIE100 YouTube Channel - https://bit.ly/SulliMIE100
- Rhett Allain – great superhero examples and others - http://bit.ly/RhettAllainWired
    - Also he has a helpful article "How to Ace Physics Class (Even if You Don't Ace Physics)" Wired August, 2021
- Dynamics YouTube Site – Yiheng Wang - http://bit.ly/YihengWang
- MIT OpenCourseware Classical Mechanics http://bit.ly/OCWClassicalMechanics
- Cornell Note taking – Medium, August, 2017. You may find this helpful to organize the ideas in this course.

References

- Gray, Gary L., Francesco Costanzo, Don Evans, Phillip Cornwell, Brian Self, and Jill L. Lane. "The dynamics concept inventory assessment test: A progress report and some results." In *American Society for Engineering Education Annual Conference & Exposition*. 2005.
- Gray, Gary L., et al. "Toward a nationwide dynamics concept inventory assessment test." *American Society for Engineering Education Annual Conference & Exposition*. Westminster, CO: IEEE, 2003.
- Evans, D. L., et al. "Progress on concept inventory assessment tools." *33rd Annual Frontiers in Education, 2003. FIE 2003.*. Vol. 1. IEEE, 2003.
- Self, Brian P., and James Widmann. "Work in progress-learning styles and performance on the dynamics concept inventory." *2009 39th IEEE Frontiers in Education Conference*. IEEE, 2009.

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