McMaster University | Civil Engineering

2023-24 COURSE OUTLINE

COURSE INFORMATION

Course Name: Engineering Mechanics: Dynamics

Course Code: 2Q03

Session Offered: Fall 2023

Calendar Description: Kinematics and dynamics of particles and rigid bodies. Work, energy and momentum principles; introduction to mechanical vibrations, free and forced vibrations of rigid and elastic systems.

Prerequisite(s): Credit or registration in CIVENG 2P04

Antirequisite(s): MECHENG 2QA4, 2Q04

Instructor(s): Dr. Moustafa Naiem Abdel-Mooty (abdelmom@mcmaster.ca)
Phone: (905) 523-9617

TA(s): Sina Biazar (biazars@mcmaster.ca)
Georgios Efstathopoulos: (efstathg@mcmaster.ca)
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Lectures: Tuesdays 1:30pm-2:20pm
AND Thursdays 12:30pm-1:20pm

Tutorial 01: Mondays 10:30am-12:20pm

Tutorial 02: Fridays 12:30pm-2:20pm

Instructor Office Hour: By Appointment – As needed

TA Office Hour: TBD

Website: Avenue to Learn (http://avenue.mcmaster.ca)
It is the responsibility of the students to check Avenue regularly.

1. COURSE OBJECTIVES

This 3-credit course emphasizes the:

- Kinematics and dynamics of particles and rigid bodies
- Motion with respect to a rotating frame of reference
- Work, energy and momentum principles
- Introduction to vibrations. (TBD)

Topics covered (depending on available time) include:

- **Particle Kinematics**
- **Particle Kinetics** (Force and Acceleration, Work and Energy, Impulse and Momentum)
- **Rigid body planar Kinematics**

- **Rigid body planar Kinetics** (Force and Acceleration, Work and Energy, Impulse and Momentum)
- **Mechanical Vibrations** (motion of a particle and rigid body) (TBD)

2. COURSE SPECIFIC POLICIES

2.1 Required Textbook(s):

- Hibbeler, R.C. (2022). **Engineering Mechanics: Dynamics**. 15th Edition. Pearson, Hoboken, New Jersey.

2.2 Alternative Textbook(s):

- Beer F.P., Johnston R.E. Jr., Cornwell P.J., Self, BP. (2019). **Vector Mechanics for Engineers: Dynamics**. 12th Edition. McGraw-Hill, New York, NY.
- Meriam, J.L., Kraige, L.G. (2015). **Engineering Mechanics: Dynamics**. 8th Edition (2015). John Wiley & Sons, Inc., Hoboken, New Jersey.

2.3 Assignments:

- Assignment must be submitted electronically on AVENUE Drop Box. **Assignments sent via email will not be marked**.
- Due dates will be indicated on the assignment sheets. **Late assignments will not be accepted**.
- Minimum standards of neatness will be expected for all assignments. These standards include neat, legible printing, use of a straight edge for straight lines, and use of an eraser to correct mistakes. Assignments will be returned UNMARKED if these standards are not met.
- Assignments are to be individual effort. Excessive collaboration on an assignment may constitute a violation of the *McMaster Academic Integrity Policy* (Section 7).

2.4 Quizzes:

- **There will be Two Midterms**.
- It is required to write both Midterms.
- It is your responsibility to make yourself available during the Midterms. There will be no alternative times to write a Midterm. **The Midterms are not MSAF-able** (Section 7).
- **If a Midterm is missed due to illness, Speak directly to the course instructor, to decide on whether it is appropriate to move forward and request accommodation from the Associate Dean's office**.

Dates of Midterms: Midterm 1: **October 3**, 2023
Midterm 2: **November 13**, 2023

3. SCHEDULE

This schedule is provided as a rough guide and may change slightly depending upon the pace of lectures. The class will be notified via A2L of any changes to the schedule.

Week	Lecture Topics (subject to change)	Chapters in Textbooks
1. Sep 4	Course Introduction, Kinematics of a particle	12 [H], 11 [B], 2 [M]
2. Sep 11	Kinematics of a particle (cont'd)	12 [H], 11 [B], 2 [M]
3. Sep 18	Kinetics of a particle: force and acceleration	13 [H], 12 [B], 3 [M]
4. Sep 25	Kinetics of a particle: work and energy	14 [H], 13 [B], 3 [M]
5. Oct 02	**Midterm 1,** Kinetics of a particle: work and energy (cont'd)	14 [H], 13 [B], 3 [M]
Oct 9	**No Classes or Tutorials**	
6. Oct 16	Kinetics of a particle: impulse and momentum	15 [H], 13 [B], 3 [M]
7. Oct 23	Planar kinematics of a rigid body	16 [H], 15 [B], 5 [M]
8. Oct 30	Planar kinematics of a rigid body (cont'd)	16 [H], 15 [B], 5 [M]
9. Nov 06	Planar kinetics of a rigid body: force and acceleration	17 [H], 16 [B], 6[M]
10. Nov 13	**Midterm 2**, Planar kinetics of a rigid body: force and acceleration (cont'd)	17 [H], 16 [B], 6[M]
11. Nov 20	Planar kinetics of a rigid body: work and energy	18 [H], 16 [B], 6[M]
12. Nov 27	Planar kinetics of a rigid body: impulse and momentum	19 [H], 17 [B], 6[M]
13. Dec 04	Vibrations / Review	22 [H], 19 [B], 8[M]
FINAL EXAMINATION	Scheduled during the regular University Final Examination period established by the Registrar's Office	

H: Hibbeler, R.C. Engineering Mechanics: Dynamics. 15th Edition (2022). Pearson. (**Required**)
B: Beer et al., Vector Mechanics for Engineers: Dynamics. 12th Edition (2019). McGraw-Hill.
M: Meriam, J.L., Kraige, L.G. Engineering Mechanics: Dynamics. 8th Edition (2015). Wiley.

4. ASSESSMENT OF LEARNING	WEIGHT %
Assignments	25%
Midterms	25%
Final Exam	50%

Note: **Students must pass the final examination to pass this course**. Students who fail the final examination will be assigned the final examination mark as their course grade.

5. LEARNING OUTCOMES

1. Ability to describe the position, velocity, and acceleration (collectively referred to as kinematics) of a particle, a system of particles, or a rigid body, using vectors in various coordinate systems (e.g., Cartesian, cylindrical polar, Frenet–Serret, etc.) [**CEAB 1.1**]
2. Ability to identify and mathematically describe kinematic constraints [**CEAB 3.2**]
3. Ability to identify and describe common forces acting on a particle, system of particles, or rigid body (e.g., friction, spring, gravity, normal) in vector form and to draw free-body diagrams [**CEAB 1.3**]
4. Ability to use balance laws (aka, Newton's Laws, Euler's Laws) to set up the equations that describe the motion (the kinetics) of a particle, a system of particles, or a rigid body [**CEAB 1.3**]
5. Ability to identify when momentum or energy is conserved [**CEAB 3.2**]
6. Ability to setup and solve practical dynamics problems either by solution of the equations of motion or using conservation laws [**CEAB 1.1, 1.3, and 3.2**]

6. LABORATORY SAFETY

- The course does not have a lab component

7. COMMUNICATIONS

It is the student's responsibility to:

- Maintain current contact information with the University, including address, phone numbers, and emergency contact information.
- Use the University provided e-mail address or maintain a valid forwarding e-mail address.
- Regularly check the official University communications channels. Official University communications are considered received if sent by postal mail, by fax, or by e-mail to the student's designated primary e-mail account via their "@mcmaster.ca" alias.
- Accept that forwarded e-mails may be lost and that e-mail is considered received if sent via the student's @mcmaster.ca alias.
- Check the McMaster/Avenue email and course websites on a regular basis during the term.

8. POLICIES

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:

- plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
- improper collaboration in group work.
- copying or using unauthorized aids in tests and examinations.

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

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.

REQUESTS FOR RELIEF FOR MISSED ACADEMIC TERM WORK

McMaster Student Absence Form (MSAF): In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work".

The McMaster Student Absence Form is a self-reporting tool for **Undergraduate Students** to report absences that last up to 5 days and provides the ability to request accommodation for any missed academic work. Please note, this tool cannot be used during any final examination period. You may submit a maximum of 1 Academic Work Missed requests per term. It is **your** responsibility to follow up with your Instructor immediately regarding the nature of the accommodation. If you are absent more than 5 days or exceed 1 request per term you **must** visit your Associate Dean's Office (Faculty Office). You may be required to provide supporting documentation. This form should be filled out immediately when you are about to return to class after your absence.

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.

PROTECTION OF PRIVACY ACT (FIPPA)

The Freedom of Information and Protection of Privacy Act (FIPPA) applies to universities. Instructors should take care to protect student names, student numbers, grades, and all other personal information at all times. For example, the submission and return of assignments and the posting of grades must be done in a manner that ensures confidentiality – see http://www.mcmaster.ca/univsec/fippa/fippa.cfm.

ANTI-DISCRIMINATION

The Faculty of Engineering is concerned with ensuring an environment that is free of all discrimination. If there is a problem, individuals are reminded that they should contact the Department Chair, the Sexual Harassment Officer, or the Human Rights Consultant, as soon as possible.
https://www.mcmaster.ca/policy/General/HR/Discrimination_and_Harassment.pdf

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.

9. MCMASTER GRADING SCALE

Grade	Equivalent Grade Point	Equivalent Percentage
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