

Course Outline

1. COURSE INFORMATION

Session Offered	Winter 2022	
Course Name	Kinematic and Dynamic- Modeling and Simulation	
Course Code	AUTOTECH 4MS3	
Date(s) and Time(s) of lectures	Monday (10:30AM-12:20PM) and Thursday (10:30AM-11:20AM)	
Program Name	Automotive and Vehicle Technology	
Calendar Description	Multi-body dynamic modelling and simulation of automotive vibrations (ADAMS software); car body modelling; complex multi-body dynamic models and parametric solid models; engine modelling	
Instructor(s)	Dr. M. Mehrdash	E-Mail: mehrtam@mcmaster.ca Office Hours & Location: Thursday (15:00-16:30)- MARC273 or by appointment

2. COURSE SPECIFICS

Course Description			
Instruction Type	Code	Type	Hours per term
	C	Classroom instruction	37
	L	Laboratory, workshop or fieldwork	36
	T	Tutorial	
	DE	Distance education	
	Total Hours		73
Resources	ISBN	Textbook Title & Edition	Author & Publisher
	ISBN10: 0-7506-5112-1 ISBN13: 9780750651127	The Multibody Systems Approach to Vehicle Dynamics	Blundell, M. & Harty, D. Elsevier (Butterworth Heinemann)
	ISBN 10: 0133915387 ISBN13: 9780133915389	Engineering Mechanics Dynamics,	Hibbeler, R. C. 14 th, Pearson
	ISBN10:0195384083 ISBN13:9780195384086	Mechanics of machines	Cleghorn, William L., and Nikolai Dechev, Oxford Press
	Other Supplies	Source	
Prerequisite(s)	AUTOTECH 2AC3, 3AV3, 3VD3, ENG TECH 3FE3, 3MN3		
Corequisite(s)			
Antirequisite(s)			
Course Specific Policies	All policies are posted on Avenue in document named "4MS3_W2019_schdule"		
Departmental Policies	Students must maintain a GPA of 3.5/12 to continue in the program. In order to achieve the required learning objectives, on average, B.Tech. students can expect to do at least 3 hours of "out-of-class" work for every scheduled hour in class. "Out-of-class" work includes reading, research, assignments and preparation for tests and examinations.		

	<p>Where group work is indicated in the course outline, such collaborative work is mandatory.</p> <p>The use of cell phones, iPods, laptops and other personal electronic devices are prohibited from the classroom during the class time, unless the instructor makes an explicit exception.</p> <p>Announcements made in class or placed on Avenue are considered to have been communicated to all students including those individuals that are not in class.</p> <p>Instructor has the right to submit work to software to identify plagiarism.</p>	
3. SUB TOPIC(S)		
Week 1	Intro to vehicle dynamics	
Week 2	Kinetic & Kinematic of Particles	Ch.12 &13 (H)
Week 3	Planar Kinetic and Kinematic of a Rigid body	Ch.16 & 17 (H)
Week 4	Work and Energy- Impulse and Momentum	Ch.18 (H)
Week 5	Spatial Kinematic of a Rigid Body	Ch.20 (H)
Week 6	Spatial Kinetic of a Rigid Body	Ch.21 (H)
Week 7	Intro. Multibody systems: Mechanism Mobility Mechanics of Planar Mechanism : Position and velocity analysis	Ch. 2 (C)
Week 8	Mechanics of Planar Mechanism : Graphical Analysis	Ch. 3 (C)
Week 9	Planar Mechanism Synthesis	Ch.7 (C)
Week 10	Spatial Kinematic and dynamic of Multibody systems (Road vehicle applications)	Ch.3 (B)
Week 11	Multibody System Simulation software	Ch. 6 (B)
Week 12	Modeling and Analysis of Suspension Systems	Ch. 6 (B)
Week 13	Modeling and Assembly of Full vehicle	Ch. 7 & Ch.8
<p>Classes end: Tuesday, April 12th 2022</p> <p>Final Examination Period: Thursday, April 14 to Friday, April 29</p> <p>All examinations MUST be written during the scheduled examination period.</p>		
List of experiments		
Lab 1	Introduction to Adams	
Lab 2	Adams – Advanced 2D multibody dynamic modelling and functions	
Lab 3	Adams – Multibody dynamic modelling and grid manipulation	
Lab 4	Adams – Advance Point Trace Mechanism design	
Lab 5	Adams – Parametric modelling	
Lab 6	Adams – Importing solid-model geometry	
Lab 7	<i>Lab test – Multibody Dynamics using Adams</i>	
Lab 8	Adams/Car	
Lab 9	CarSim I	
Lab 10	CarSim II	
Lab 11	Matlab and Simulink	
Lab 12	Make-up Lab	
<p>Note that this structure represents a plan and is subject to adjustment term by term.</p> <p>The instructor and the University reserve the right to modify elements of the course during the term. The University may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes.</p>		
4. ASSESSMENT OF LEARNING *including dates*		Weight
Term Test 1		15

Term Test 2	15
Quiz (two quizzes)	8
Lab Test	15
Labs	6
Lab Assignments	6
Final examination (tests cumulative knowledge)	35
TOTAL	100%

Percentage grades will be converted to letter grades and grade points per the University calendar.

5. LEARNING OUTCOMES

1. Analyze kinematics and dynamics of rigid bodies using an analytical approach
2. Investigate mechanical systems using multibody system analysis
3. Develop models of automotive subsystem using multibody system simulation software
4. Simulate the dynamic behavior of mechanical automotive subsystems
5. Evaluate the dynamic response of full-vehicle models on various road surfaces
6. Prepare technical reports on modeling automotive systems and on evaluating simulation results
7. Design and refine automotive subsystems using specialized CAE and FEA software packages

6. POLICIES

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.

http://www.mcmaster.ca/policy/General/HR/Discrimination_Harassment_Sexual_Harassment-Prevention&Response.pdf

Academic Integrity

You are required to exhibit honestly and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

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.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various kinds of academic dishonesty please refer to the Academic Integrity Policy, located at: <http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicIntegrity.pdf>.

The following illustrates only three forms of academic dishonesty:

1. Plagiarism. E.g. the submission of work that is not 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.

Requests for Relief for Missed Academic Term Work (Assignments, Mid-Terms, etc.)

The McMaster Student Absence Form is an on-line self-reporting tool for **Undergraduate Students** to report absences for:

- 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:
 - Students may submit a maximum of one academic work missed request per term. It is the responsibility of the student to follow up with instructors immediately (within the 3 day period that is specified in the MSAF) regarding the nature of the accommodation. All work due in that time period however can be covered by one MSAF.

- MSAF cannot be used to meet religious obligation or celebration of an important religious holiday, for that has already been completed or attempted or to apply for relief for any final examination or its equivalent.
- 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 not been used previously in that term:
- Students must visit their Associate Dean's Office (Faculty Office) and provide supporting documentation.

E-Learning Policy

Consistent with the Bachelor of Technology's policy to utilize e-learning as a complement to traditional classroom instruction, students are expected to obtain appropriate passwords and accounts to access Avenue To Learn for this course. Materials will be posted by class for student download. It is expected that students will avail themselves of these materials prior to class. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail account, and program affiliation may become apparent to all other students in the course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about this disclosure please discuss this with the course instructor. Avenue can be accessed via <http://avenue.mcmaster.ca>.

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.

Turnitin (Optional)

This course will be using a web-based service (Turnitin.com) to reveal plagiarism. Students submit their assignment/work electronically to Turnitin.com where it is checked against the internet, published works and Turnitin's database for similar or identical work. If Turnitin finds similar or identical work that has not been properly cited, a report is sent to the instructor showing the student's work and the original source. The instructor reviews what Turnitin has found and then determines if he/she thinks there is a problem with the work. Students who do not wish to submit their work to Turnitin.com must still submit a copy to the instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, etc.). To see the Turnitin.com Policy, please go to <http://www.mcmaster.ca/academicintegrity/turnitin/students/>

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 posting of grades must be done in a manner that ensures confidentiality. <http://www.mcmaster.ca/univsec/fippa/fippa.cfm>

Academic Accommodation of Students with Disabilities Policy

Students who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail sas@mcmaster.ca. For further information consult McMaster's policy for Academic Accommodation of Students with Disabilities

<http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicAccommodation-StudentsWithDisabilities.pdf>

Students must forward a copy of the SAS accommodation to the instructor of each course and to the Program Administrator of the B.Tech. Program immediately upon receipt. If a student with a disability chooses NOT to take advantage of a SAS accommodation and chooses to sit for a regular exam, a petition for relief may not be filed after the examination is complete. <http://sas.mcmaster.ca>

Student Code of Conduct

The Student Code of Conduct (SCC) exists to promote the safety and security of all the students in the McMaster community and to encourage respect for others, their property and the laws of the land. McMaster University is a community which values mutual respect for the rights, responsibilities, dignity and well-being of others. The purpose of the Student Code of Conduct is to outline accepted standards of behavior that are harmonious with the goals and the well-being of the University community, and to define the procedures to be followed when students fail to meet the accepted standards of behavior. All students have the responsibility to familiarize themselves with the University regulations and the conduct expected of them while studying at McMaster University.

http://studentconduct.mcmaster.ca/student_code_of_conduct.html