

Course Outline

1. COURSE INFORMATION

Course Code	AUTOTECH 3VD3	
Course Name	Mechanical Vibrations	
Session	Fall 2015	
Date(s) and Time(s) of lectures	September 8 – December 8, 2015 Tuesday 2:30 pm - 3:30 pm & Thursday 2:30 pm – 4:30 pm	
Program Name	Automotive and Vehicle Technology	
Calendar Description	Single degree of freedom systems; free vibration; harmonically excited vibration; vibration under general forcing conditions; two degree of freedom systems; multi-degree of freedom systems; natural frequencies and mode shapes; vibration control; vehicle oscillations.	
Instructor	Name: Dr. Timber Yuen	E-Mail: timber@mcmaster.ca Office: MARC 270

2. COURSE SPECIFICS

Course Description	Mass, Spring and Damping Elements; Effects of Spring Pre-load; Static Stiffness and Dynamic Stiffness; Free Vibrations; Effects of Oscillation Frequency and Damping Factor on Decay Time; Forced Vibrations; State Space Solutions for Forced Vibrations; Suspension Tuning; Multi-Mode Vibrations; Frequency Domain Analysis; Beating; Fast Fourier Transform; Base Excitation; Rotating Unbalanced; Displacement & Force Transmissibility; Use of Accelerometers; Accelerometer Data Analysis; Vibration Control Techniques; 2 DOF Systems; Vibration Absorber Design and Implementation; Mode Shapes and Design for Ride Comfort.		
Instruction Type	Code	Type	Total Hours
	C	Classroom Instruction	39
	L	Laboratory, workshop or fieldwork	12
	T	Tutorial	
	DE	Distance Education	
	TOTAL HOURS		51
Resources	ISBN	Textbook Title & Edition	Author & Publisher
	0-471-34555-5	Mechanical Vibration, 2007	Palm, John Wiley & Sons
	Other Supplies	N/A	
	Book Available	At the McMaster Campus Store	
Prerequisite(s)	AUTOTECH 3AE3, AUTOTECH 3CT3, ENG TECH 3FE3 and registration in the Automotive and Vehicle Technology Program		
Corequisite(s)	N/A		
Antirequisite(s)	N/A		
Course Specific Policies	All assignments and lab reports must be handed in before or on the due date. Late submissions will be subjected to a 20% penalty.		
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		

	<p>in class. “Out-of-class” work includes reading, research, assignments and preparation for tests and examinations.</p> <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. Instructor has the right to submit work to software to identify plagiarism.</p>	
3. SUB TOPIC(S)		
Week 1	<p>Introduction</p> <ul style="list-style-type: none"> • Equation of Motion • Mass, Stiffness & Damping Elements • Dynamic Stiffness • Springs in Parallel & in Series 	
Week 2	<p>Free Vibration</p> <ul style="list-style-type: none"> • Damped Natural Frequency • Damping factor (zeta) vs Damping Coefficient, Effects of zeta and natural frequency on system response & decay • Effects of Mass, Stiffness & Damping on ζ & ω_n 	
Week 3	<p>Forced Vibration & Frequency Response</p> <ul style="list-style-type: none"> • Solving DE with Sinusoidal Inputs • Complete solution vs State Space Solution • Doing Bode Plots in Excel • Suspension Tuning - Vehicle Weight Distribution • Effects of location of heavy components 	
Week 4	Forced Vibration & Frequency Response (Part 2)	
Week 5	Review & Mid Term Test 1	
Week 6	Study Break	
Week 7	<p>Multi-Mode Vibration</p> <ul style="list-style-type: none"> • Fun with Frequency Analysis • Beating • Fast Fourier Transform (FFT) 	
Week 8	<p>Base Excitation & Rotating Unbalance</p> <ul style="list-style-type: none"> • Displacement Transmissibility • Force Transmissibility • Effects of Frequency Ratio • Vibration Control Methods 	
Week 9	Base Excitation & Rotating Unbalance (Part 2)	
Week 10	Review & Mid Term Test 2	
Week 11	2 DOF Systems & Vibration Absorbers (Part 1)	
Week 12	2 DOF Systems & Vibration Absorbers (Part 2)	

Week 13	Ride Comfort <ul style="list-style-type: none"> • Vehicle Vibration Mode Shapes • Final Review 	
<p>FINAL EXAMINATIONS will be scheduled, conducted and invigilated by the Office of the Registrar. All students entering the examination room must produce a McMaster photo identification card. No other identification will be accepted. In addition, for classes that allow you to use a calculator, you must use the McMaster standard calculator. For details, please consult your Instructor.</p>		
<p>Note: this structure represents a plan and is subject to adjustment term by term. 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		Weight
Assignments (x3)		0%
Mid Term Test 1		24%
Mid Term Test 2		24%
Lab Reports		15%
Final Exam		37%
TOTAL		100%
Percentage grades will be converted to letter grades and grade points per the University calendar.		
5. LEARNING OUTCOMES		
1. Relate real world components to vehicle dynamic system mathematical model parameters		
2. Evaluate the performance of mass, spring and damping elements in free vibrations		
3. Evaluate the performance of mass, spring and damping elements in force vibrations		
4. Predict the performance of dynamic system under the effects of harmonic inputs		
5. Design vibration control systems to achieve the required vibration reduction criteria		
6. Design vibration absorbers for dynamic systems to control vibrations		
6. POLICIES		
Anti-Discrimination		
<p>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.</p> <p>http://www.mcmaster.ca/policy/General/HR/Anti-Discrimination%20policy.pdf</p>		
Academic Integrity		
<p>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.</p>		
<p>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.</p>		
<p>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.</p>		
<p>The following illustrates only three forms of academic dishonesty:</p>		
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.)		
<p>The McMaster Student Absence Form is a self-reporting tool for Undergraduate Students to report absences that last up to 3 days and provides the ability to request accommodation for any missed academic</p>		

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 3 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.
<http://www.mcmaster.ca/msaf/>

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://judicialaffairs.mcmaster.ca/pdf/SCC.pdf>