ENGINEERING
McMaster-Mohawk
Bachelor of Technology
Partnership

McMaster University

Course Outline

1. COURSE INFORMATION

Session Offered	Winter 2022	
Course Name	Advanced CAD	
Course Code	AUTOTECH 2AC3	
Date(s) and Time(s) of lectures	C01: Tuesdays 9:30am-11:20am and Thursdays 2:30pm-4:20pm C02: Tuesdays 11:30am-1:20pm and Thursdays 9:30am-11:20am C03: Tuesdays 1:30pm-3:20pm and Thursdays 11:30am-1:20pm	
Program Name	Automotive and Vehicle Engineering Technology	
Calendar Description	Parametric solid modeling for parts with complex geometry. Wireframe and complex surfaces. Multi-component assemblies with kinematic constraints. Fitting and kinematic animations for assemblies. Simulation analysis on solid models.	
Instructor(s)	Dr. Lucian Balan	E-Mail: balanl@mcmaster.ca Office: on-line delivery / MARC 271

2. COURSE SPECIFICS

Course Description

Advanced CAD modeling techniques based on parametric modeling software used in automotive/aerospace industry; modeling parts with complex geometry; relational dimensioning; geometrical and dimensional constraints; creation of solid models for parts with complex shapes; integration of wireframe and complex surfaces; assembly creation from parts and sub-assemblies; assembly constraints and kinematic joints; fitting and kinematic animations for assemblies; use of kinematic constraints to simulate motion of mechanisms and video animation generation; interference and collision detection, part design adjustment; Engineering design with project constraints; conceptual design and design cycle; brainstorming, decision making, and concept selection; design with modeling and simulation; problem identification and design refinement

Instruction Type

Code	Type	Hours per term
C	Classroom instruction	50
L	Laboratory, workshop or fieldwork	
T	Tutorial	
DE	Distance education	
	Total Hours	50

Resources

ISBN	Textbook Title & Edition	Author & Publisher
978-0-07-170026-9	Catia core tools Computer-aided three-dimensional interactive application (optional)	Michel Michaud. McGraw Hill

Other Supplies	Source
PC/Laptop with webcam needed	Students must have own computer and adequate internet bandwidth for remote access of software for on-line lecture, tutorials, tests, and exam

Prerequisite(s)	AUTOTECH 2AE3, 2CD3, and registration in level II or above of the Automotive and Vehicle Engineering Technology program.

Corequisite(s)	N/A
Antirequisite(s)	N/A
Course Specific Policies	o This course will be delivered partly on-line using Zoom platform and partly in-person as per university policy o E-mail communication for this course is through McMaster email (balanl@mcmaster.ca) o Licensed software (SolidWorks and Catia) is provided in computer lab to be accessed remotely. The university is not responsible for providing individual software licenses to students enrolled in this course or for installation support of the software on personal laptops. o The computer lab has open access intervals during regular hours to allow students to complete their homework remotely. The instructor will communicate accessibility and availability times. o Students must attend virtual/in-person labs/lectures and submit the required in-class proof of work where required. o Due dates for course work will be posted on course website or communicated in class. Students are responsible for knowing the assignment deadlines, cut-off dates, exams, and any other announcements made during the class time, or posted on the course website o For projects submitted as group work, the grade will account for individual contribution of each student to the project work. Where required, intermediate project submissions at distinct stages will be considered for project grading. o The instructor will assign the members of each project groups randomly o In-class project meetings sessions are mandatory. Teamwork and individual participation are included in project grading. Projects are submitted as group work but graded individually based on each student's contribution to the project. o Project work requires outside of regular class hours. Students are expected to spend a minimum of six hours out-of-class per week for each project assigned. The work submitted should reflect student's own work. o Late projects are marked with a penalty of 5% per day, up to a maximum of five days, after which the project will be graded with zero. o Students are required to keep a copy of their course work (excluding tests, exams, quizzes) on a personal storage device for all lab sessions. Weekly back-ups for individual project work are mandatory. o All term tests and exams to be performed on PCs in the computer lab through remote access or in-person as per university requirement. All work must be completed and submitted in the specifically required format. Students are fully responsible for the content of their electronic submissions. o If allowed, and students decide to use own computers for tests or exam, they must accept fully responsibility if their own PCs may not be able to handle properly the software used in this course.

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. Where group work is indicated in the course outline, such collaborative work is mandatory. 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. 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.

3. SUB TOPIC(S)		
Week 1	Engineering Design o Introduction o Design phases o Approach and methods	
Week 2	Engineering Design o Project constraints o Design concepts o Design cycle	
Week 3	Engineering Design o Applied concepts using SolidWorks o Use of CAD libraries	
Week 4	Engineering Design o Motion Study o Kinematics Plots and Analysis	
Week 5	*Project 1 presentations (2 hours)* Basic concepts in CATIA o Commands, setup, toolbars o Workbenches o Compass tool and part manipulation	
Week 6	Parts design and sketcher o Sketch o Geometric and dimensional constraints o Features and basic shapes	

	o Advanced sketcher o Boolean operations on parts o Part editing	
Week 7	Assembly design o Insert components o Insert subassemblies o Assembly constraints o Contextual design o Part editing and manipulation in assembly	
Week 8	Kinematic simulation o Mechanism creation o Kinematic joints generation o Motion simulation o Video animation generation	
Week 9	Assembling operation simulation o Fitting simulation o Tracks creation o Sequences generation o Clash detection	
Week 10	Wireframe and complex surfaces o Generative shape design workbench o Advanced surface generation techniques o Multi-section surfaces, blend, sweep	
Week 11	Advanced modeling methods o Iso-parametric curves and laws o Extrapolating curves and surfaces o Gear parametric template	
Week 12	*Project 2 presentations*	
Week 13	Review Final Exam	

Classes end: Tuesday, April 12th 2022
Final Examination Period: Thursday, April 14 to Friday, April 29
All examinations MUST be written during the scheduled examination period.

Note that 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.

4. ASSESSMENT OF LEARNING *including dates*	**Weight**

Project 1 (engineering design) –*week 5*	25%
Project 2 (modeling and kinematics) –*week 12*	35%
Final examination (tests cumulative knowledge)	40%
TOTAL	**100%**

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

5. LEARNING OUTCOMES

1. Design detailed parts and assemblies using advanced solid modeling techniques. Create parts with complex shape and surfaces using wireframe and complex surface generation tools available in the modeling software
2. Insert and modify parametric modelled components in an assembly; identify design errors; perform measurements and collision analyses
3. Combine assembly constraints, motion laws, and kinematic joints to produce realistic simulation of the product's kinematic motion and its assembling procedure
4. Solve an engineering design open-end project with given constraints by using modeling and simulation techniques. Use brainstorming, decision making, concept selection, and team collaboration to achieve required functionality.
5. Identify problems in conceptual design process and provide engineering solutions through iterative design cycle.
6. Create and improve product design and functionality using team project work

6. COURSE OUTLINE – APPROVED ADVISORY STATEMENTS

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 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: 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.

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.

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".

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. http://www.mcmaster.ca/policy/Students-AcademicStudies/Studentcode.pdf

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.