ME 4634 Introduction to Computer Aided Design and Manufacturing

Syllabus • Spring 2017 • CRN 15642, 15643, 15644

LECTURE: Mondays / Wednesdays • 10:10AM - 11:00AM • 129 McBryde Hall

LABORATORY: 114-E Randolph Hall (VT CAD Laboratory) ***see timetable for times***

Occasionally, the Friday 10:10AM – 11:00AM timeslot will be used to make up cancelled classes.

Audience

- 2nd semester Juniors; seniors; and beginning graduate students in engineering
- This course is an approved ME design technical elective, and it is approved for graduate credit
- Pass/Fail or audits are not allowed

Prerequisites

General engineering design background and an interest in applying this knowledge using state-of-the-art, commercial CAD/CAM software systems

Course Professor

Dr. Jan Helge Bøhn

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Office Hours:	Mondays & Wednesdays, 9:00 AM – 10:00 AM, and by appointment

Textbooks and Study Materials

- *e-Design: Computer-Aided Engineering Design*, Kuang-Hua Chang, Academic Press, 2015, ISBN 978-0-12-382038-9
  Available free online from the Virginia Tech library
- *Design for Six Sigma: a roadmap for product development*, Kai Yang and Basem El-Haik, McGraw-Hill: 1st ed., 2003, ISBN 0-07-141208-5; 2nd ed., 2009, ISBN 0-07-154767-3
  First edition is available free online from the Virginia Tech library
- Course information and materials will be made available online on Canvas and/or at:
  http://www.cadlab.vt.edu/ME4634/

Overall Learning Objectives

At the successful completion of this course, the students should have:

1. Developed a general understanding of fundamental CAD/CAM concepts;
   DELIVERY METHOD: Course lectures
2. Learned how to use commercial CAD/CAM software for engineering design; and
   DELIVERY METHOD: Laboratory workshops
3. Learned how CAD/CAM can be used in the different stages of design and manufacture of a product.
   DELIVERY METHOD: Homework assignments and term project

Major Measurable Learning Objectives

Having successfully completed this course, the student will be able to:

1. Describe what constitutes a CAD/CAM system, and what elements and factors that are important in the creation of CAD/CAM software;
2. Describe the history of and current industrial uses of CAD/CAM;
3. Describe the various standards pertaining to computer graphics and CAD/CAM software;
4. Explain the mathematical formulations, characteristics, and properties of popular parametric geometric curves and surfaces, including Hermite, Bézier, B-spline, and NURBS curves, and ruled, Coons, Hermite, Bézier, and B-spline surfaces;
5. Explain and demonstrate the basic use and operation of a major commercial PDM software system in a team design and development environment; and
6. Carry out all phases of the design of a mechanical assembly using a major commercial CAD/CAM software system in a team environment.

Course Format

- Two one-hour lecture meetings and one three-hour laboratory meeting per week. The students automatically sign up for the lecture section and for one of the laboratory sections. The emphasis of the lectures will be on the fundamental and theoretical issues of CAD/CAM. The emphasis of the laboratories will be on the practical exposure to high-end CAD/CAM/CAE (NX, CATIA, and Creo) and PDM systems (Teamcenter Engineering). The majority of the laboratory work will involve the use of the NX 11 CAD/CAM/CAE software system.

- The laboratory sections will meet during the first week of classes to create computer accounts, learn to use the *3Dconnexion SpaceMouse Pro* input device, and start the first NX 11 workshop. Students that register late for the course (or have a Monday or Tuesday laboratory session) and thus miss their first week's laboratory should attend another laboratory section's meeting that week to catch up at that time.

- A written, comprehensive final exam as scheduled by the registrar (see timetable). This exam is required, with the exception for those students that are excused by the Dean of Engineering. The emphasis of this exam will be on the lecture material and the reading assignments.

- An applied midterm exam that is to be taken in the VT CAD Laboratory during the designated regular scheduled laboratory section meeting. The emphasis of this exam will be on the use of NX 11 to generate a solid model of a mechanical device and to generate the corresponding 2D standard drawing for this device. Each student must complete this exam in its entirety in the VT CAD Laboratory during the student's regularly scheduled laboratory section period.

- A series of laboratory assignments, and affiliated out-of-class homework assignments tied to the term project, aimed at familiarizing students with the CAD/CAM software that will be used in completing the term project.

- The laboratory assignments (workshops) are designed and intended to be completed during the assigned laboratory period. During these laboratory periods, the students will have first-rights to a workstation, and a graduate teaching assistant (GTA) will be on hand for assistance and for having the completed work checked off. Students must complete and have their laboratory assignments checked off by the course GTA during their assigned laboratory period; or, if they attend the entire laboratory period, by the beginning of the following laboratory the next week. To accommodate illnesses, scheduling conflicts, etc., a student may miss up to three (3) laboratory assignments, provided that they are completed and checked off by the beginning of the following laboratory period. This is a fixed deadline without exception. It is the student's responsibility to ensure that their work is checked off by the deadline; no credit will be given for work shown after that deadline.

- A mechanical design and manufacturing term project with objectives including some or all of the following: design for Six Sigma, assembly, and manufacturing; conceptual design; cost estimation; preliminary design and design analysis; solid modeling; final design; process planning; numerical control part programming; and documentation. Students will work in teams of five or six and choose their own projects, subject to approval of the course professor. The team members do not all need to be enrolled in the same laboratory section.

- Students that believe they have extenuating circumstances that should be considered (e.g., why a particular piece of work should be considered after its deadline) may submit to the course professor a typed memorandum explaining the situation. This memorandum will be placed in ***The Folder*** for consideration at the end of the semester when letter grades are assigned. Students with large numbers of memoranda, "collective catch-up" memoranda, or memoranda submitted weeks after the deadline, are generally afforded diminished consideration.

- No work will be accepted after 5:00PM Wednesday, May 3, 2017. This includes memoranda intended for ***The Folder***.

The Honor Code

As a Hokie, I will conduct myself with honor and integrity at all times. I will not lie, cheat, or steal, nor will I accept the actions of those that do.

Students enrolled in this course are responsible for abiding by the Honor Code. A student who has doubts about how the Honor Code applies to any assignment is responsible for obtaining specific guidance from the course instructor before submitting the assignment for evaluation. Ignorance of the rules does not exclude any member of the University community from the requirements and expectations of the Honor Code. For additional information about the Honor Code, please visit: http://www.honorsystem.vt.edu

THE HONOR CODE WILL BE STRICTLY ENFORCED IN THIS COURSE. ALL ASSIGNMENTS SUBMITTED SHALL BE CONSIDERED GRADED WORK, UNLESS OTHERWISE NOTED. ALL ASPECTS OF YOUR COURSE WORK ARE COVERED BY THE HONOR SYSTEM. ANY SUSPECTED VIOLATIONS OF THE HONOR CODE WILL BE PROMPTLY REPORTED TO THE HONOR SYSTEM. HONESTY IN YOUR ACADEMIC WORK WILL DEVELOP INTO PROFESSIONAL INTEGRITY. THE FACULTY AND STUDENTS OF VIRGINIA TECH WILL NOT TOLERATE ANY FORM OF ACADEMIC DISHONESTY.

Each assignment description will state if the assignment is to be an individual or a team effort. In the case of individual assignments, it is expected that the work submitted is yours alone. In the case of team assignments, it is expected that the work submitted is that of the team members listed on that assignment; furthermore, each team member is equally responsible for that no other team member committed plagiarism. However, with the exception of the midterm and final examinations, you are strongly encouraged to discuss freely with others the concepts involved.

Grading Policy

- Written comprehensive final exam 30%
  Friday, May 5, 2017, 1:05PM-3:05PM,
  129 McBryde Hall (see timetable for possible changes)
- Term project 20%
- Applied in-laboratory midterm proficiency exam 20%
- Laboratory assignments (workshops) 10%
- Out-of-class homework (mostly term-project related) 20%

Attendance

Attendance is important and expected, but not required. Students are responsible for material issued or covered during the lecture meetings and/or laboratory section meetings. Students that miss these meetings are expected to consult their classmates for material covered and for copies of materials issued.

In-Lecture Technology Use

Electronic devices, including computers and telephones, may not be used during lectures for anything but note taking and activities specifically permitted and requested by the instructor.

Grade Scale

The following grading scale will be used when converting to letter grades:

A	=	92.5	–	100.0
A-	=	90.0	–	92.499
B+	=	87.5	–	89.999
B	=	82.5	–	87.499
B-	=	80.0	–	82.499
C+	=	77.5	–	79.999
C	=	72.5	–	77.499
C-	=	70.0	–	72.499
D+	=	67.5	–	69.999
D	=	62.5	–	67.499
D-	=	60.0	–	62.499
F	=	0.0	–	59.999