ME 172

ENGINEERING GRAPHICS - Principles and Applications

(COMPUTER-AIDED DESIGN)

COURSE SYLLABUS

INSTRUCTOR: Dr. C. Greg Jensen - Mechanical Engineering
435 CTB
422-6540
cjensen@byu.edu

Office Hours: M-F 1:00 – 2:00PM

TAS: Check the TA Schedule Handout

COURSE DESCRIPTION AND PHILOSOPHY: *This course focuses on the principles and techniques of 3-dimensional surface and solid modeling. This course teaches students how to model real-world engineering objects and assemblies using the capabilities of commercial CAD systems. Conceptual, preliminary and detailed part and assembly models are assigned as exercises to reinforce the theoretical classroom lectures. This course teaches the graphics language and standards necessary for engineering students to read, understand and sign-off engineering drawings and documents. Students are required to detail (create engineering drawing) their CAD models, demonstrating their ability to both read and apply graphic standards. In short this course focuses on* CAD-based modeling and engineering graphics standards (national – ANSI and international – ISO), including coordinate and geometric dimensioning and tolerancing practices.

COURSE OUTCOMES:

1. Understand wireframe, surface and solid modeling techniques found in a modern commercial CAD package.
2. Create CAD models of basic machine components and assemblies.
3. Design and create CAD models of average to complex mechanical components.
4. Understand the approaches and processes used in component and assembly modeling, i.e. top-down and bottom-up design.
5. Read and understand engineering drawings composed of multiple views with standard dimensioning and tolerancing nomenclature.
6. Read and understand engineering drawings that contain geometric dimensioning and tolerancing symbols.
7. Work in collaboration with fellow teammates to accomplish both the learning of the CAD tool and the executing of the modeling projects.

COURSE OBJECTIVES:

- Model components selected from the automotive, aerospace and watercraft industries.
- Learn (understand) the language of engineering graphics, correctly apply the language in the CADD description of 3-dimensional parametric CAD solid models, while learning a third-generation CAE/CAD/CAM system.
- Learn Top-down and Bottom-up design and modeling methods and apply them to component and assembly modeling assignments.
- Prepare students for meaningful and productive employment within an automated engineering, design and manufacturing environment.
- Stimulate interest in and reinforce the need for extended learning in the areas of computer-aided engineering applications and CAx application software development.
- Motivate students to accept the task of maintaining an attitude of life-long learning as it relates to CAx tools.

PREREQUISITES: Engineering or Technology major status.

TEXT: Each student should have in their possession an Engineering Graphics, Engineering Design, Graphics Communications, Technical Drawing, or Technical Graphics textbook. These books will have in excess of 700 pages, usually something closer to 1000 pages; **they are not an "Introduction to …" or "A Primer for …"**, which generally have only the first six or seven chapters of the textbook you are looking for; **so check the page count before buying**. Also you **are not looking** for an engineering graphics book that is **"… with AutoCAD … or "… with SolidWorks …"** these books spend more time covering an old version of CAD software than discussing engineering graphics. A complete "Graphics" textbook typically runs $160-$200 *new;* even more at traditional bookstores. Some used "Graphics" textbooks can be purchased for a little as $1. Some of these textbooks are in their 10^{th} or 11^{th} editions, and demand a high price; however, older editions still have the foundational information, techniques and methods covered in this class. For example, I still own the engineering graphics textbook I used as a freshman back in the early 70's; I would estimate that over 85% of what is contained in this book is still relevant when creating or reading today's engineering drawings. Whatever price you pay, I would recommend that your get your book as soon as possible. You will want a "Graphics" reference book to read in preparation for and support of the topics and materials covered in each lecture period. Amazon, eBay and other online bookstores are good places to find affordable used engineering graphics books. Here are some authors you may want to check out; Gary Bertoline, Frederick Giesecke, James Leake, Dennis Lieu, …

If you plan to be an engineer/technologist, then I strongly recommend that you plan to keep your purchased graphics textbook as a life-long reference. It will be a valuable resource throughout your career.

Because Engineering Graphic is the language in which engineers communicate it is very important that you get one of these books as soon as possible. Below are a few links that will

help you in your search for a suitable textbook. But before click on the links consider the following:

1. If you can afford a new book and will not need to sell it back to buy future book purchases then buy new and I would suggest the book by Dennis Lieu. Else;
2. Buy used, hardbound, and as recent editions as you can afford, without the need to sell it back. Else,
3. If there is no budget for any used graphic textbook, not even $5-10, then go to the Lee Library and checkout one of their engineering graphic textbooks for the whole semester (or as long as you can).
4. Any book you select should cover the following topics:
    a. Technical Sketching
    b. Axonometric and Oblique (and other Perspective) Projections
    c. Multi-view Projections
    d. Sectional Views
    e. Auxiliary Views
    f. Dimensioning
    g. Tolerancing
    h. Hardware (Threads, Fasteners, Springs, Gears, Cams, …)
    i. Working and Assembly Drawings
    j. Newer books will have a chapter or two on Geometric Dimenisoning and Tolearancing (if you choose one without this there will be class notes and handouts for this topic)

READINGS: Each week there will be assigned readings from your textbook, refer to the Lecture Schedule handout.

COMPUTERS: All members of the class will need a CAEDM account, which gives you access to both the Linux and Windows Engineering Workstations. These systems can be found in rooms 450 CTB, 230, 308, or 425 of the CB. These systems support many different CAE, CAD, CAM application packages such as CATIA, NX, Pro/ENGINEER, Solid Edge, SolidWorks, etc. In addition these computer terminals provide access to Microsoft Office applications, programming in C/C++, Mathematica, Maple, etc. You will be expected to use these workstations to construct 3-dimensional models, engineering drawings and demonstrate the ability to communicate using the engineering graphical language.

CALCULATORS: Are useful in this class and can be used during **tests**.

THUMB OR USB DRIVES: All students are required to have their own storage or backup media, which should be used on a very regular basis.

TEAMWORK: You will divide yourselves into teams of, ***at most***, 2 people during the second week. Your team member should be someone that is in your lab section and has similar open study times to yours. The intent is, that team members will study and complete ***group lab assignments*** together. It is also hoped that teams will go to the CAD Lab together to work on assignments. I would envision the team members sitting at adjacent workstations, ***each working on their own models*** (parts or components), but sharing their insights with the other team member. ***In some cases it is acceptable*** to build just one model (air engine) as a team and turn in ***one lab assignment, see the Grading Section below***. The only way to learn CAD tools and techniques is to get into the text, on-line help, and use the systems with your own fingers on the keyboard.

PERSONAL CLASS JOURNAL: Each student is to keep a personal ME 172 Class Journal/Notebook that tracks the events (lectures, labs, and personal study) accomplished during the semester. The very best notebooks are the ones that have enough information and detail that would allow the author to be away from CAD/Engineering Graphics for say two years and using only the notebook quickly regain forgotten knowledge and skills.

This assignment/exercise is to also give you experience in creating your first engineering journal/notebook. Engineers in all fields commonly carry and meticulously keep bound notebooks that capture their best ideas and inventions, read http://www.wisegeek.com/what-is-an-engineering-notebook.htm.

Your journal is an excellent place to:

- record class notes (consistent quality notes; 25pts)
- sketch (regular sketches that show improvement; 25pts)
- record planning sessions for homework, labs, and test problems, etc. (15pts)
- record questions you wish to ask the TA's or professor (5pts)
- record of what was submitted and when (5pts)
- keep time logs dedicated to class activities, i.e. computer time, study time, etc. (15pts)
- show professionalism, i.e. it is not the job, but how you do the job (10 pts)

One can also find ways of including graded homework, quizzes, tests, etc. that will stand as a record of your progress and achievements. Your journal will be subjectively graded based on the **quality** and **quantity** of its contents and is worth ~10% of your total grade.

QUIZZES AND HOMEWORK: I reserve the right to start each class/lab period with a **short quiz** to encourage your learning of assigned material. Homework will be assigned in class/lab and will emphasize/reinforce the CAD theory and techniques discussed. The assigned problems are representative of what you will see on the scheduled tests. Each homework assignment has a published rubric the graders will use to consistently/fairly grade your homework. Assignments are to be turned in at the beginning of each lab, otherwise the Late Policy applies. **Once graded homework (or a quiz) is returned you have only one (1) week to resolve any grading issues.** (*Graded homework and quizzes not picked up in class can be picked up from the **ME 172 Turn Back Slot** on the 4th floor of the CTB.*) In the event you want an assignment regarded, meet with the appropriate graders who will treat it as though it had never been graded, i.e. your score may as easily go down as it may go up. **Note:** Those homework and quizzes left in the turn back slot after the midterm and again after the final will be discarded.

LAB ASSIGNMENTS: The labs are written so that you should be able to complete each exercise within the allotted hours, ***if you work smart.*** However, there is no upper limit on the amount of time required of the unprepared or unorganized student. Lab assignments are to be turned in at the beginning of lab, otherwise the Late Policy applies. **Once a graded lab is returned you have only one (1) week to resolve any grading issues.** In the event you want a lab regarded, meet with the appropriate graders who will treat it as though it had never been graded, i.e. your score may as easily go down as it may go up.

LATE POLICY: After an assignment has been graded and turned back (or placed in the turn-back box) no additional submissions of this assignment will be accepted, unless prior written (via email) approval has been given. All work turned in after the appointed time and before the grading of this assignment is completed will be penalized 10% per day (not counting Sunday).

Portions of an assignment CANNOT trickle in, part on time and part late. If **unusual circumstances arise** which will prevent you from turning work in on time, contact me (via email) **before** the assignment is due and I will grant an extension if I feel it is warranted. Otherwise, late work will be marked down according to the policy above. Please note that the computers and/or printers go down from time to time (sigh!) and does not justify turning an assignment in late. Plan accordingly, i.e. due your work early in the week!

GRADING: The final assigned grades are typically curved based on a point-total somewhere between total points (1500) and high person. The curved letter grades are based on; 100% — 90% (A — A-), 89% — 80% (B+ — B-), 79% — 70% (C+ — C-), 69% — 60% (D+ — D-) scale. The 1500 points possible are allocated as follows:

Midterm Exam	150 points
Final exam	200 points
Quizzes	90 points
Homework	485 points
Labs	475 points
Personal Class Journal	100 points
	1500 points

Individual Homework Assignments	
0.) Preface	5 points
1.) Design/Sketching	15 points
2.) Sketcher/Basic Expressions and Constraints	55 points
3.) One View Drawings	30 points
4.) Basic Solids	50 points
5.) Solid Features	40 points
6.) Other Solid Features	60 points
7.) Yet More Solid Features	20 points
8.) Surface Modeling	30 points
9.) Assembly Modeling/Drawing	40 points
10.) More Assembly Modeling	30 points
11.) Geometric Dimensioning and Tolerancing	50 points
12.) Creating a full set of Working Drawings	60 points
Total	485 points

Labs		**Group (drawings)**	**Individual (modeling)**
1.) Wheel Rim	(L-1g, L-1i)	60 points	75 points
2.) Header	(L-2g, L-2i)	65 points	50 points
3.) Sunglasses	(L-3i)		75 points
4.) Air Engine	(L-4g, L-4i)	150 points (models 75pts. and drawings 75pts.)	
Total Points	**475**	200 points	275 points

NOTES:

• ***If you are having trouble, please come see me as soon as possible.***

• ***Remember, I always look forward to talking with students in my office or lab about the concepts discussed in class.***

TA HOURS: The class TAs will be available during the scheduled lab sessions. There are also approximately 40 hours per week that the TAs are available in the open CAD lab in 450 CTB (refer to the TA Schedule). Please plan your work so that you can seek help during one or more of these scheduled times. We want to focus our help efforts on those hours when we can actually look over your shoulder, see what you are doing and make suggestions and recommendations. Remember the TA's are a resource, they are mentors and have been instructed to **not do your work but to assist in finding answers and learning the skill and techniques associated with modern CAD systems**.

ATTITUDE: After teaching for 20+ years, I have come to realize that most students have positive, polite, constructive attitudes and do all in their power to make the classroom and laboratory environment pleasant and enriching. However, on rare occasions, I have experienced a few students that once challenged by the course material or frustrated by the computer hardware or software, become disruptive to the learning process and a negative influence in the classroom and laboratory. I would request that all of you maintain a professional attitude, if problems arise, visit me during my office hours where I believe you will find me a reasonable person to work with.

HONOR CODE: Dr. Karl G. Maeser said, "I trust you all. I give you my confidence. I hope you will do nothing to weaken that confidence. I put you on your word of honor." I echo his sentiments. It is common knowledge that old tests, labs, and homework assignments/models are available from former students. ***You are on your honor not to refer to or use these materials in any way.*** The work you turn in must be your own work or the work of your group and must reflect your own level of understanding. It is acceptable, however, for a group of students or teams to work on their individual models at the same time, each sharing the benefits of his experiences with the others.

Also, in this class, ***I expect all students to abide by the Dress and Grooming Standards of BYU***.