Boston University
ENG ME 414 Capstone Project

Spring 2011

COURSE INFORMATION SHEET – ALL SECTIONS

(COURSE SYNOPSIS: Prereq: ENG ME 413. Continuation of ENG ME 413 focusing on the capstone senior design project, in which students conceive, plan, and carry out a significant mechanical engineering design project, working in groups. Also included are machine elements not covered in ME 413, such as bearings, gears, belts, brakes, clutches, and springs; finite element analysis; common manufacturing techniques; project management; project cost estimation; professional liability; and engineering ethics. Written reports and oral presentations required. 4 cr, 2nd sem.)

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Textbooks: Dieter, G.E. and L.C. Schmidt, Engineering Design, 4th ed., McGraw-Hill, 2009.

Juvinall, R.C. and K.M. Marshek, Fundamentals of Machine Component Design, 4th ed., Wiley, 2006.

Computation Notebook RR 77255 (Green cover, quad 5 to 1", UPC: 070972772557)

Lumsdaine, E., M. Lumsdaine, and J.W. Shelnutt, Creative Problems Solving and Engineering Design, McGraw-Hill, 1999. (Recommended)

Recommended shop manual: Machinery's Handbook, 27th ed., Industrial Press, 2004 (Contact Joe Estano for ordering information at a special reduced price.)

(Note: These same textbooks were required for ME 413.)

Grading:

	Indiv.	Group
Professionalism (including class & professional societies)	5%	
Design journal	5%	
Homework (machine elements and FEA)	5%	
Midterm test (machine elements)	10%	
Engineering ethics assignments	5%	
Preliminary Design Report (written report)		15%
Preliminary Design Report (oral presentation)	5%	
Detail Design Report (written report)		15%
Final Design Report (written report)		20%
Final Design Report (oral presentation)	10%	
Working model or prototype (submitted to customer)		5%

Notes: **Note on required special evening classes for all sections:**

On **Wednesday, March 2, 20011, 8-10 p.m.,** we will have the Midterm Test for all sections. Please plan ahead to be available at this time. As we did last semester, if you have a commitment until 9 p.m. you may take the test 9-11 p.m. Please contact Prof. Isaacson to arrange this. A make up exam will be given only for very extenuating circumstances. We will not be having class during regular times that Wednesday and Thursday.

On **Tuesday, March 22, 2011**, **6-8 p.m**., we will have a special lecture on finite element analysis (FEA). Unless you have another regularly scheduled class at that time, you are expected to attend the lecture. Please contact Prof. Isaacson if you have another class scheduled at this time. We will not be having class during regular times that Monday and Tuesday.

Note on revision of preliminary design: Within the first two weeks of the semester you must address the weaknesses found in your proposed preliminary design and must develop an acceptable preliminary design. This design will be presented in a formal written report and oral presentation in just three weeks. Joe, Bob, and Dave, as well as the course instructors, are available for consultation outside of class.

Note on initial team meetings with department machinists: Within the first week of class, teams must meet with Joe, Bob, and Dave (sign up on sign up sheet, outside ENG B07). As many team members as possible should be at this meeting, but not all are required to attend. At the meeting you should present your proposed design to the machinists and discuss with them the practicality of the design and the specific part of the design that can be fabricated (and whether as prototype or mock-up) given time, material, and personnel constraints.

Note on initial team meetings with project customers: FOR TEAMS WITH PROJECT CUSTOMERS: Please set up a meeting with your customer and your course instructor (if possible) within the first two weeks of classes. The purpose of the meeting is to present your proposed design to your customer to be sure it will satisfy your customer's requirements.

Note on professional societies: You are required to be (or become, if you are not already) a member of an engineering professional society. ASME is recommended, but not required. Engineering honor societies such as Tau Beta Pi and Pi Tau Sigma will not satisfy this requirement; however, societies such as SWE and MES will satisfy it. The deadline for becoming a member is February 28, 2011. For societies other than ASME, you must provide proof of membership in an e-mail to Prof. Isaacson. Membership in ASME will be checked automatically. This is worth 1% in your final term numerical score.

Note on assignments and academic honesty: The academic honesty pledge you signed last semester was for both ME 413 and ME 414 and is also in effect this semester (see attached pledge). Homework on machine elements should be done individually, unless you identify on each homework problem what help you received from what source. This is the same policy followed last semester in ME 413. The assignments on FEA and engineering ethics must be done individually. All assignments should be handed in according to standard Mechanical Engineering Department homework format (see below), where applicable, or as user friendly stand alone reports. Assignments must be handed in when due. If an assignment is not handed in on time, without an acceptable excuse, you will receive no credit for it. If you will not be in class on the due date, send your assignment in to class with another student, leave it with the receptionist in the ME Department Office and ask to have it put in the instructors mail box, FAX it to the Department (617-353-5866) addressed to the instructor, or send by regular mail (postmarked by due date).

Note on design journal use: The design journal is A PERSONAL LOG/DIARY/JOURNAL of the student's HANDWRITTEN DRAWINGS and NOTES THAT IS TO BE MAINTAINED THROUGHOUT THE COURSE. You should maintain in the notebook a COMPLETE record of your activities related to this class: time spent on machine design problems, notes of project group meeting, notes from research related to projects, ideas that crop up in your mind in the middle of the night and wake you from a sound sleep. Many good ideas have been lost because they were not written down right away. Every page should be numbered, dated and signed. The Journal will be collected periodically through the semester for grading, as well as at the end of the course.

Note on peer evaluations: There will be written peer evaluations a number of times through the semester. These confidential evaluations, done by all members of a design team, are a way of feeding back to both the course instructors and the individual students how well individuals are functioning as members of teams. These evaluations will affect the "group" portion of your individual course grade.

Note on financial support for model or prototype: The model or prototype developed for your project is the property of your customer (or the ME Department if you have no identified customer). It is to be left with your

customer (or the Department) on completion of the project. This is the professional approach. By accepting the project proposed by your customer, you have entered an implicit contract to produce the product. The customer has been waiting all year for your product, and may well have sought it elsewhere if you had not agreed to supply it, so there is a cost to your customer even if he/she has not paid money for the product. In addition to being of use to your customer, prototypes are important to the Department to show future students as well as our accreditors and other visitors.

Funding of each team by the ME Department is capped at $200. This funding is for the purchase of supplies, equipment, and fabrication services for the prototypes or models. This is in addition to funds your customer may supply. Please use this money wisely. Often donations of parts can be obtained from companies. You are encouraged to seek such donations.

Final Exam: There is no final exam scheduled for this course.

Drop Date: Tuesday, February 22, 2011 (no "W" on record).

Withdrawal: Friday, April 1, 2011 (with a "W" on record). **NO WITHDRAWALS WILL BE ALLOWED AFTER APRIL 1st.**

Incomplete: Incompletes will be permitted only for very extenuating circumstances. They must be arranged for before the end of classes.

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COURSE SYLLABUS – ALL SECTIONS
(1/4/11)

January

18,19 Introduction.
Team meetings
Choose new team leaders.
(Sign up now outside ENG B07 for team meetings with Joe, Bob, and Dave between Jan. 18 - 26.)

20,24 Machine elements: Rolling-Element Bearings
(Reading: J: Ch. 14)

25,26 Machine elements: Gears I
(Reading: J: Ch. 15)

27,31 Machine elements: Gears II
(Reading: J: Ch. 16)

February

1,2 Machine elements: Brakes and Clutches I
(Reading: J: Ch. 18)

3,7 Machine elements: Brakes and Clutches II

*4 Engineering Career Fair

8,9 **Preliminary Design Reports – written and oral reports DUE** (Clear and complete description of the actual structure of your preliminary design, including subsystems. You must convince your audience through clear and correct feasibility analyses that your design will work and satisfy your primary customer requirements. Include, in the body of your report a complete listing of customer requirements and engineering specifications, but give explanations only for changes and additions from your Preliminary Design Proposals of last semester. More information on the content and format of the report will be given in the Preliminary Design Report assignment sheet. In the oral report, concentrate on the structural description of your final design and the proof it will work. **Oral report time: 3 min. for each team member + 10 min. questions and feedback.**)
Choose new team leaders
Peer evaluation

10,14 Machine elements: Belts and Chains I
(Reading: J: Ch. 19)

15,16 Design team meetings: Feedback on Preliminary Design Reports (Teams must have solved problems identified in Preliminary Design Presentation, with solutions presented in good drawings, INCLUDING SUB-SYSTEMS. Check with Joe and Dave before these meetings if solutions are adequate and **if you should start ordering special parts**. For parts to be fabricated, begin work on detail design shop drawings and consult with Joe and Dave if they are sufficient for the Detail Design Report.)

17,22 Machine elements: Belts and Chains II
(NOTE: MONDAY SCHEDULE ON TUESDAY)

23,24 Design team meetings

*25 Order of the Engineer Ring Ceremony (National Engineers Week)

28,1 Project time

March

*2 **Midterm exam (individual) on machine elements – All sections 8-10 p.m. (Wed.) If you are delayed due to an officially scheduled BU activity, you will be able to take the test 9-11 p.m.**

7,8 Design process: Manufacturing techniques and project cost estimation I
(Reading: D: Ch. 9)

9,10 **Detail Design Report – written report DUE** (These are final designs. Include component analysis and optimization, bill of materials, and CAD 3-view shop drawings along with assembly drawings; as well as complete listing of requirements, specifications, benchmarking, and design decisions – including feasibility and optimization analyses. You do not have to include your HOQ and all of the reasoning behind the weightings and degrees of connectivity.)
Choose new team leaders
Peer evaluation

Design process: Manufacturing techniques and project cost estimation II
(Reading: D: Ch. 14)

*22 Finite Element Analysis (FEA) – **All sections 6-8 p.m. Required Lecture.**
(Begin shop fabrication of end products. Continue ordering of parts.)
(Reading: D: Ch. 7&8; J: Sect. 5.16; L: pp. 343-345)

23,24 Scheduled design team meetings: Feedback on Detail Design Reports – **Mandatory resubmission if unacceptable**

28,29 Professional Ethics I
(Reading: CourseInfo; D: Ch. 15)

30,31 Professional Ethics II

April

4,5 Scheduled design team meetings with **brief written progress report DUE**

6,7 Project work time

11,12 Scheduled design team meetings with **brief written progress report DUE**

13,14 Project work time

19,20 **Prototype demos – Demonstration of work in progress on model, mock-up, or prototype.**

21 Project work time – **All student shop work completed. Shop access restricted on 21nd.**
(NOTE: MONDAY SCHEDULE ON THURSDAY)

25,26 Project work time

27,28 Project work time

May

2,3 Project work time

4,5 **Final Design Report – WRITTEN reports DUE**
Peer evaluation
Curriculum assessment

6 Senior project presentation practice session

9 **Senior Project Day – Final Design Report – ORAL Presentations DUE**