BU ENG ME 413 Machine Design Fall 2011 COURSE INFORMATION SHEET – ALL SECTIONS

Course Coverage:

First part of the Mechanical Engineering capstone design sequence. Application of fundamental engineering concepts to the design process, including fatigue, load analysis, and factors of safety. Analysis and specification of elements commonly found in mechanical systems, including fasteners, bearings, and other power transmission elements. The contours of the engineering design process, including problem definition and documentation of requirements, feasibility analysis, and conceptual design. Essential skills and structures for productive teamwork. Oral and written communication of technical information. First stages of the capstone design project. (The design sequence continues in ME 414.)

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Staff Member	Primary Phone	e-Mail	Office	Office
	Other Phone		Location	Hours
Prof. Frank A. DiBella	781-937-4718	fdibella@conceptsnrec.com	ENG 307	As
Instructor	617-353-6616			arranged
Prof. William Hauser	617-358-0663	wmhauser@bu.edu	EMB 144	Thur
Instructor / Course Coordinator	978-681-1866			1:00 - 4:00
Prof. Morton S. Isaacson	617-353-2825	isaacson@bu.edu	ENG 207	ТВА
Instructor	781-891-3207			
Mr. Ali Beyzavi	Contact by e-	<u>beyzavi@bu.edu</u>	ENG 117	Thursday
Graduate Teaching Fellow	mail			3:00 - 6:00
Mr. Joe Estano	617-353-6653	jestano@bu.edu	ENG 110	
ME Laboratory Manager				
Mr. David Campbell	617-353-3952	dcampbel@bu.edu	ENG 203	
ME Laboratory Engineer				
Mr. Robert Sjostrom	617-353-4246	sjostrom@bu.edu	GCB B05	
CIM Specialist / Lab				
Supervisor				
ENG = 110 Cummington Street	EMB = 15	5 St. Mary's Street GCB	= 750 Com	monwealth

Course Staff:

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Class Meeting Place and Time:

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A1	Isaacson	PHO 205	Tue, Thur	10:00 - 12:00
A2	DiBella	PHO 205	Mon, Wed	6:00 - 8:00
A3	Isaacson	PHO 205	Mon, Wed	2:00 - 4:00
A4	Hauser	PHO 202	Mon, Wed	2:00 - 4:00
A5	Hauser	PHO 202	Tue, Thur	10:00 - 12:00

The A1 and A5 and the A2 and A4 sections will sometimes meet together in PHO 205. Joint meetings will be announced.

Required Textbooks (Available at BU Bookstore or at various sites online):

• Robert C. Juvinall; Kurt M. Marshek, *Fundamentals of Machine Component Design*, 4th ed., ISBN 9780471661771 (The basic text for ME413 and ME414. The hard-cover edition [non-electronic] is permitted in exams and quizzes except when otherwise noted.)

• *Notebook-Value Marble Quad 100*, XX Supply, ISBN 9780471661771 (Bound notebook for recording of project design information. Notebooks will be collected and evaluated from time to time during the course.)

Additional References:

- *Machinery's Handbook, 28th ed.*, Industrial Press, 2008, ISBN 978-0-8311-2800-5 (Contact Joe Estano for ordering information at a reduced price. Also available in large print and CD-ROM editions. Earlier editions remain useful. Check online availability.)
- Edward Lumsdaine; Monika Lumsdaine; J. William Shelnutt, *Creative Problem Solving* and Engineering Design, 1999, ISBN 978-0-07-236058-5
- George Dieter; Linda Schmidt, *Engineering Design*, 4th ed., 2009, ISBN 9780072837032, (Useful as a reference on the design process, but can be challenging as a tutorial for first-time readers.)
- David G. Ullman, *The Mechanical Design Process*, 4th ed., 2009, ISBN 0072975741 (Useful as a reference on the design process. Accessible style. Earlier editions remain useful.)
- Robert L. Norton, *Machine Design*, 4th ed., 2011, ISBN 9780136123705 (Parallels the content of the course text. Provides useful alternate expositions if the treatment in *Juvinall* is not accessible.)
- Jack A. Collins, *Mechanical Design of Machine Elements and Machines*, 2nd ed, 2009, ISBN-13: 9780470413036 (Parallels the content of the course text. Provides useful alternate expositions if the treatment in *Juvinall* is not accessible.)
- Richard Budynas; J. Nisbett, *Shigley's Mechanical Engineering Design*, 9th ed., 2011, ISBN 9780073529288 (The grandfather of mechanical design textbooks. All other texts are, to some extent, derivatives of Shigley. Parallels the content of the course text. Provides useful alternate expositions if the treatment in *Juvinall* is not accessible.)

Grading:

Grades have both an individual and a team component. The starting point in determining a student's grade in a team effort is the performance of the team as a whole. That is, with no other information, each member of the team would usually receive the same grade. Nonetheless, an individual may receive a lower or higher grade than the team as a whole, depending on such inputs as peer evaluations, comments from customers, comments from shop personnel, or significantly different effectiveness in oral presentation. In recent times, individual performance has been marked up or down relative to the team as a whole by as much as a full grade, e.g., B+ lowered to C+, based on peer evaluation confirmed by the instructor's own observations. More severe adjustment is possible in cases where a team member is clearly non-contributing.

Quizzes, homework, exams, design journal, and attendance are counted as measures of a student's individual performance.

The table below documents the weight assigned to individual and team elements for the Capstone Project and for Design Foundations (failure analysis and machine elements).

Weight Assigned to Grading Elements:

	Project	Foundations
Individual Elements (60%)	-	
Homework and quizzes		20
Final Exam		15
Project oral presentations	10	
Design Journal, Attendance, Shop	10	
Individual Design Exercises	5	
Team Elements (40%)		
Project Report I (Problem definition)	15	
Project Report II (Design proposal)	20	
Group Design Exercises	5	
	65	35

Academic Misconduct:

Your behavior in this course is bound by the 2011-2012 Boston University Academic Conduct Code found at the website <u>http://www.bu.edu/academics/academic-conduct-code</u>. You are responsible for understanding the requirements of this code. As stated there, "violations include, but are not limited to

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- A. **Cheating on examination.** Any attempt by a student to alter his of [sic] her performance on an examination in violation of that examination's stated or commonly understood ground rules.
- B. Plagiarism. Representing the work of another as one's own. Plagiarism includes but is not limited to the following: copying the answers of another student on an examination, copying or restating the work or ideas of another person or persons in any oral or written work (printed or electronic) without citing the appropriate source, and collaborating with someone else in an academic endeavor without acknowledging his or her contribution. Plagiarism can consist of acts of commission-appropriating the words or ideas of another-or omission failing to acknowledge/document/credit the source or creator of words or ideas (see below for a detailed definition of plagiarism). It also includes colluding with someone else in an academic endeavor without acknowledging his or her contribution, using audio or video footage that comes from another source (including work done by another student) without permission and acknowledgement of that source.
- C. **Misrepresentation or falsification of data** presented for surveys, experiments, reports, etc., which includes but is not limited to: citing authors that do not exist; citing interviews that never took place, or field work that was not completed.
- D. **Theft of an examination.** Stealing or otherwise discovering and/or making known to others the contents of an examination that has not yet been administered.
- E. **Unauthorized communication during examinations.** Any unauthorized communication may be considered prima facie evidence of cheating.
- F. **Knowingly allowing another student to represent your work as his or her own.** This includes providing a copy of your paper or laboratory report to another student without the explicit permission of the instructor(s).
- G. Forgery, alteration, or knowing misuse of graded examinations, quizzes, grade lists, or official records of documents, including but not limited to transcripts from any institution,

letters of recommendation, degree certificates, examinations, quizzes, or other work after submission.

- H. Theft or destruction of examinations or papers after submission.
- I. Submitting the same work in more than one course without the consent of instructors.
- J. Altering or destroying another student's work or records, altering records of any kind, removing materials from libraries or offices without consent, or in any way interfering with the work of others so as to impede their academic performance.
- K. Violation of the rules governing teamwork. Unless the instructor of a course otherwise specifically provides instructions to the contrary, the following rules apply to teamwork: 1. No team member shall intentionally restrict or inhibit another team member's access to team meetings, team work-in-progress, or other team activities without the express authorization of the instructor. 2. All team members shall be held responsible for the content of all teamwork submitted for evaluation as if each team member had individually submitted the entire work product of their team as their own work.
- L. Failure to sit in a specifically assigned seat during examinations.
- M. Conduct in a professional field assignment that violates the policies and regulations of the host school or agency.
- N. Conduct in violation of public law occurring outside the University that directly affects the academic and professional status of the student, after civil authorities have imposed sanctions.
- O. Attempting improperly to influence the award of any credit, grade, or honor.
- P. Intentionally making false statements to the Academic Conduct Committee or intentionally presenting false information to the committee.
- Q. Failure to comply with the sanctions imposed under the authority of this code."

Homework:

Homework is intended to reinforce your understanding of material covered in lectures or in assigned readings. Some assignments may be required to be handed in. Others may not. Homework is most useful when you solve the assigned problems yourself, as an individual. For homework which is to be handed in and graded, if you use sources of help, including fellow students, previous solution sets, or solution manuals, you must state what sources of help you used. If you do this, it will not affect your homework grade, which will be based on the quality of your effort. Receiving help on any graded assignment, and not acknowledging it, is a violation of the academic standards of this course. In any case where students collaborate on the completion of an assignment, homework or other, the names of all participants in the collaboration must be disclosed.

Please recognize that the people reviewing and grading homework will handle dozens of papers from multiple sections of the course. To facilitate record keeping, and to be sure your homework is returned in the proper section of the class, it is important to identify your paper clearly, with the following information noted at the top of each page:

ut the top of each page.
Marybeth Knowles
ME 413 Section A1
HW #1, 16 Sept 2011

Homework improperly identified or submitted late may be rejected or penalized. If you know that you will not be in class on the date an assignment is due, it is your responsibility to send it with a fellow student, or to submit it to the department office not later than it would otherwise be due.

Design Journal:

The engineering design journal is a personal log/diary/journal of the student's handwritten calculations, drawings, and notes. It is to be maintained throughout the course. Keep the journal with you at all times to record ideas that may come when least expected, such as those that hit in the middle of the night. You should maintain in the notebook a complete record of activities related to your capstone project: notes of group meetings, notes from research related to projects (e.g., interviews, library or internet work, experimentation and testing), development of your design concepts, and analyses.

All analyses related to your project should be referenced in the journal. Hand calculations should be done directly in the journal. Computer analyses should be included as problem statements, explanations, and numerical results, with reference to the full analysis contained in a separate notebook or as an appendix in a formal written report. Every page should be numbered, dated and signed. The Journal will be collected periodically for grading, as well as at the end of the course.

Peer Evaluations:

Success in this course, as well as in many real-world jobs, depends not only on your individual performance, but also on the achievements of your team. The capstone projects are large efforts; everyone is expected to contribute. No one should expect to coast and depend on the work of others. Written peer evaluations will be conducted at various points during the semester. These confidential evaluations, done by all members of a design team, provide feedback both to the course instructors and to the individual students. These evaluations will affect individual course grades. Their primary purpose, however, is to identify problems early – before they develop into major impediments to effective teamwork, and before they detract from the success of your project.

Designs and Prototypes:

Please also note that 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. By accepting the project proposed by your customer, you enter into an implicit contract. The customer will have been waiting all year for your product, and might 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. In addition to being of use to your customer, prototypes are important to the Department to show to future students as well as to our accreditors and other visitors.

If you have special situation, or any concerns about the ownership of the physical model or intellectual property contained in your design, you should make those concerns known to the instructors so that they may be addressed and the resolution may be properly documented. Concerns raised after a design is well underway are difficult to deal with, so issues, if they arise, should be made known early. In our experience, issues around ownership of prototypes and/or intellectual property arise infrequently.

Reports and Presentations:

Capstone Project Final Reports and recordings of Capstone Project Final Presentations will be retained by the department and may be used in the instruction of future classes. When so used, grades awarded to the reports will not be revealed. However, the fact that a project was judged best for its year would ordinarily be revealed.

Final presentations will be recorded (video and audio) and may be streamed live to coworkers, relatives, and friends of the presenters, to alumni and friends of the Department, and to others with an interest in the topics being presented.

Professional registration:

Professional registration is required in most application areas where engineers have direct contact with the public and are involved in projects that directly affect public welfare. Engineers who work as team members in large companies are often not required to be registered. Nonetheless, it is difficult to anticipate where your career may take you, and registration is most easily accomplished by starting the process while you are still in school. Registration is a three step process: (1) successfully passing the Fundamentals of Engineering (FE) Exam; (2) working in a responsible engineering position for some length of time (usually on the order of four years); and then (3) successfully passing the Professional Engineering (PE) Exam in your specialty area. Even if you are not planning on becoming a registered professional engineer, passing the FE exam may give you an advantage in seeking your first job offer.

The FE exam is a general exam covering all aspect of the generally accepted background for engineering. It is at the B.S. level, and most students who take it do so towards the end of their senior year. The Mechanical Engineering Department has had a policy of subsidizing one-half the cost of the exam (total cost around \$200) for any department senior who takes the exam and reports his/her grade back to the department. More details about the exam will be made available to you at the start of the spring semester through ME 414 and ASME. In ME 413 sign conventions and other aspects of the solution of structural analysis problems will be consistent with those used on the FE exam.

Make-ups: Make-up tests will be given only under extreme circumstances. They must be arranged for well in advance of the scheduled exam. As with most other issues, if you think there may be an issue, make it known early. It is difficult to deal with last-minute requests.

Final Exam: The date of the final exam will be announced as soon as it is available from the University Registrar. Do not make travel plans for a date prior to the end of exam week, until you know the dates of all your final exams, confirmed by your instructors.

Facilities:

You will have 24/7 card access to the ME Senior Computational Design Lab (SCUDLab), ENG 114; to the shop project area, ENG B07; and to the Engineering Computation Lab (ECL), EMB 125 – except for times when regularly scheduled classes meet in ECL. If your Tarrier Card does not work in these labs, please see the receptionist in the ME office. Please keep these facilities neat and clean for the benefit and safety of all users and to reduce the chances of attracting vermin. Remember that a cluttered workspace is more likely to be a hazardous workspace. Please note that the facilities are meant only for students in the ME Department, and pay attention to security issues. <u>Do not leave the laboratory doors unlocked</u>. The software available in the SCUDLab includes:

- Algor
 Comsol
 MS Office
 Solidworks
- Ansys Matlab MS Project Pro-E Wildfire

Session	A2, A3, A4	A1, A5	Topics
1	7-Sep	8-Sep	Introduction: Info Sheet & Syllabus
			Course Administrative Details
			Nature & Scope of Capstone Project
			Call for project ideas
			Requirement for ME413 Fact Sheet
			Review of previous project presentation (in-class video)
2	12-Sep	13-Sep	Shafts: tolerance and fits
3	14-Sep	15-Sep	Capstone Project Idea Submissions Due (optional)
			Executive-Summary-Rewrite Exercise Due
			Executive-Summary-Rewrite Discussed in Class
4	19-Sep	20-Sep	Safety Factors, Modeling of Loads, Buckling
5	21-Sep	22-Sep	Failure Analysis - Static Stress, Mohr's Circle
6	26-Sep	27-Sep	Stress & Strain Review: Static Stress
7	28-Sep	29-Sep	Failure Analysis - Impact
8	3-Oct	4-Oct	Quiz: Basic Knowledge, Load Modeling, Buckling //
			Fatigue (Completely reversed, Start)
9	5-Oct	6-Oct	Fatigue (Completely reversed, continued)
-	10-Oct	11-Oct	Monday = Columbus Day; Tuesday = Office Hours
10	12-Oct	13-Oct	Quiz: Impact // Customer Requirements, QFD
11	17-Oct	18-Oct	Customer Requirements (Continued)
12	19-Oct	20-Oct	Written & Oral Report Skills
13	24-Oct	25-Oct	Generation of design concepts: Functional
			Decomposition & Morphological Charts
14	26-Oct	27-Oct	Quiz: Fatigue // Generation of design concepts
			(continued)
15	31-Oct	1-Nov	Team work day; no class meeting; office hours
16	2-Nov	3-Nov	Project Report I (Problem Definition)
			Design Journal Grading
17	7-Nov	8-Nov	Peer Evaluations // Evaluation of design concepts -
			feasibility analysis
18	9-Nov	10-Nov	Team Meetings for f/b on Project Report I
19	14-Nov	15-Nov	Fatigue - Fluctuating
20	16-Nov	17-Nov	Fatigue - Fluctuating // Screws & Fasteners (Start)
21	21-Nov	22-Nov	Screws & Fasteners (continued)
-	23-Nov	24-Nov	Thanksgiving Holiday
22	28-Nov	29-Nov	Screws & Fasteners (End) / Rolling element bearings
23	30-Nov	1-Dec	Rolling element bearings (End) // Program assessments
			Peer evaluations // Course evaluations
24	5-Dec	6-Dec	Team work day; no class meeting; office hours
25	7-Dec	8-Dec	Project Report II (Design Proposal)
			Design Journal Grading
	TBD	TBD	FINAL EXAMINATION

Version History

Issue 1.0	8/29/2011	Original Issue
Issue 1.1	8/31/2011	Session-by-Session Schedule Appended