EK156 DESIGN AND MANUFACTURE
SPRING 2012

COURSE SYLLABUS

Prof. T. A. de Winter
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Office hours: Monday 7-8AM, 2-4PM
Tuesday 7-11:15AM, 1-4PM
Wednesday 7-8AM, 2-4PM
Thursday By appointment only
Friday 7:00-11:15AM
Text: Groover, Fundamentals of Modern Manufacturing, 4th edition, Wiley
ISBN 0-471-74485-9
Classroom: 8 St. Mary's Street, Room PHO 211
Time: Friday, lectures: Group B 1:00-2:00PM
Group A 2:00-3:00PM
Friday, lab demos: Group A 1:00-2:00PM
Group B 2:00-3:00PM
Agganis Arena: Section 112, Row Q, seat 2
Lab demonstration locations: see attached schedule
Grad. Teaching Fellow: Ellie Ntakou, ntakou@bu,edu
Grader: Jake Koningswood, jsk3@bu.edu

The format of the course will consist of a 1 hour lecture each Friday, and a laboratory demonstration. Attendance will be taken at both the lectures and the demonstrations. The locations of the demonstrations and the membership of each group of students for each demonstration will be announced. In order to be effective, the lab demo groups will be 10-15 students each.

The CAD demonstrations will be on Solidworks. There will be a CAD assignment, and all EK156 students will be assigned a Solidworks account. Those Mechanical Engineering Majors who complete the course with a passing grade will be allowed to continue to use their accounts for all course related projects for the rest of their undergraduate years at BU ENG.

Boston University has an honor system, and the work you submit for grading is expected to be your own. On your exams you will be required to affirm that the work you are submitting is your own by signing a short statement to that effect, a copy of which is shown on the attached typical exam cover. While the homework doesn't require an individual statement like the exams, it is expected to be your own work.

The following pages detail the grading, the reading and the lecture schedules for the semester.

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LECTURE AND LABORATORY SCHEDULE

DATE	LAB.*	LECTURE	READING	REMARKS
Jan. 20	No Lab**	Introduction	Introduction	Ch. 1
Jan. 27	Lab	Material Properties, Project Description	Ch. 2, 3, 4	
Feb. 3	Lab	Surface Effects	Ch. 27, 28, 29	Project concept approval
Feb. 10	Lab	Metals and alloys	Ch. 6	
Feb. 17	Lab	Casting	Ch. 10, 11	
Feb. 24	No Lab	Power point project proposal presentation and hard copy		
Mar. 2	Lab	Bulk Deformation Take home exam handed out, due Monday, March 5	Ch. 18, 19	
Mar. 9	Lab	Sheet metal forming	Ch. 20	
Mar. 23	Lab	Joining, Fastening	Ch. 30, 31, 32, 33	Progress Report
Mar. 30	Lab	Machining	Ch. 21, 22, 23, 24	
Apr. 6	Lab	Exotic Machining, Grinding	Ch. 26,27	
Apr. 13	Lab	Polymers, Composite Materials, Ceramics Project Presentation, 3-4PM	Ch. 7, 8, 9	
Apr. 20	Lab	Rapid Prototyping, Integrated circuits, MEMS, nanotechnology	Ch. 20, 28, 29, 38	
Apr. 27	Lab	Costs, scheduling, quality control		

Exam #1 Take home, March 2 – March 5
Exam #2: Take home, to be scheduled

All lectures are held on Fridays in Room PHO 211
All reading assignments are from the assigned course text
* Lab locations and demo schedule are detailed in the attached Lab Demo Schedule

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PROJECT DESCRIPTION

In engineering, the vast majority of work can best be described as projects. A project has a design and analysis phase, and a manufacturing phase. The mantra of the successful engineer is: "On schedule, to specifications and within budget". Nothing comes close as second best to that mantra.

In order to drive this home in EK156, all students will be required to generate the design of a product, estimate the cost of the materials, plan the schedule of implementing(producing) the design, and then actually make the product.

In order to accommodate the large enrollment in the course and the finite access to the Mechanical Engineering Machine Shop, Welding and Casting facilities, the project will be done by teams of 3 students. A project concept must be approved by January 29. Approval may be obtained from Bob Sjostrom or Prof.de Winter on the project design, after which each team is cleared to order the project materials. Each team must meet in consultation with one or more of the following Mechanical Engineering Department members to discuss their design, the materials selection, cost estimate and the method of producing the design. The team may meet with the Graduate Teaching Fellow, Bob Sjostrom or Prof. de Winter. In designs requiring welding, casting, brazing or soldering, Kara Mogensen will have to be consulted. All team members must be present at such meetings, and the consultant will sign off on the meeting report sheet. The project proposal must be presented by power point in front of the class on February 24. Hard copies of the proposal are due at that presentation.

It is useful for engineers to consider the two likely outcomes of any project or venture, success or failure. Actually there are an infinite number of degrees of success or failure. But it is useful to think of the two extremes when engaged in a project. If the project is a success, we want to replicate it over and over in the volume production of the product or design. If it is a failure in any sense, we want to analyze what caused the failure and make sure it doesn't happen again. Both the replication of success and the avoidance of a repeat failure require that the process parameters be available for analysis. Data you don't have, is data you can't use in this strategy. Documenting what you are doing, when you are doing it and how you are doing it is essential if you want to look back on the process and make improvements.

It is important to document your design, and the steps you are taking to implement it, in order to be able to replicate your success or to avoid repeating your failures. The final project report is designed to force you to debrief yourself on the project. If you were to make a second version, what would you do differently? What changes did you make in the schedule, in the design, in the materials, in the way you produced the product, and why?

It is only by following this process that engineers get better, by realizing your mistakes when they are fresh in your mind, by determining not to leave the writing of the report to the last minute, but to allow some time to do a thorough job on it.

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Think about it, if your project turned out exactly as you planned and budgeted it, if the design was not modified, if the materials were purchased in exactly the quantities you planned, if their cost estimates were "dead on" and if every step was carried out as scheduled, you wouldn't have to write a final project report because all you would need is a new title page for your proposal.

While we cannot simulate raises in salary or promotions (or terminations) which accompany success or failure in industry, it is important to have your eye on the big picture.

If, when employed as an engineer in industry, your boss calls you into her office and tells you that an important customer has asked your company to prepare a proposal and she is putting you in charge of preparing that proposal. In general it takes an officer of the company to sign such a proposal, and you will have to convince that officer that the company can successfully complete the project, by meeting the schedule and the specifications and make a profit while having a good chance to beat the competition with your price. If you succeed in convincing the officer of all that, the proposal will be sent out to the customer containing the following statement (in much greater detail of course):

"Our company will furnish all materials, labor, subcontracts and facilities in order to design, manufacture, test, deliver and install the product to your specifications, and guarantee its performance, on or before the delivery date at the quoted price"

Weeks later you are called into your boss's office again, and when you walk in she says: "I have good news and I have bad news". Without waiting which you would like to hear first, she informs you of the good news, "the company got the job thanks to the proposal you prepared, congratulations". While you are wondering what could possibly be the bad news, it is not long in coming. "You said we could do it, prove it", she adds, "it is your baby".

If you complete that project, "ON SCHEDULE, TO SPECIFICATIONS AND WITHIN BUDGET", your next assignment will be more important. It will be more important to your company, and not incidentally to your career.

The EK156 project is intended to give you a taste of this process and to familiarize you with the design process and with methods of manufacturing, hence the course title: DESIGN AND MANUFACTURE.

In industry, team projects usually require a division of responsibility. Individual tasks are assigned to individual team members and regular meetings are held to monitor progress and to schedule and assign the next tasks.

While it would seem that simulating this type of efficiency should be encouraged in EK156 projects, it would detract from the experience that each team member is required to

get from the project and the course. To have one member do the proposal, while another member takes care of parts and materials and a third one schedules and witnesses the machining deprives each member from experiencing the entire project in all its significant phases.

Part of the importance of working in a team is to help coordinate the work and to be at meetings on time. This builds confidence in each member's commitment and dependability.

Each phase of the project is to have the participation of all the project group members. While some of this will be difficult if not impossible for the instructor to monitor,

One footnote on the proposal. The Mechanical Engineering Department holds an annual Design Portfolio Competition. The concept of a design portfolio is essentially a collection of work of which you are proud, which can be presented as evidence of your efforts during an interview for an internship or a full-time position. Keep this in mind when preparing your proposal for this course, that it can be a building block and a substantial start of your design portfolio.

While variety is expected in the project designs, projects involving weapons or games and devices to promote excessive drinking or other hazardous behavior will not be approved.

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COURSE WORK AND GRADING

An attendance sheet will be circulated in class each day. It is your responsibility to sign the sheet before the start of the next class in the classroom. Excessively and chronically late students may not get full credit for signing the attendance sheet after the end of the class. A separate attendance sheet will be used to record attendance in the laboratory demonstrations.

1. Homework: homework will be assigned, each to be completed in a week. The homework will be due at the start of class on Friday.

2. Project: In the course, in teams of two or three students you are required to design and build a project of your choice and to manage it as an engineering project in industry. The design has to be yours and the project must be built from scratch. The project should require 30 to 60 hours to design and build. Students are strongly urged to do a project using metal or plastics as building materials. Kits or commercially available designs are not acceptable.

3. Project Proposal: Written proposals for the projects selected are to be written and handed in according to the course schedule. Two copies of the proposal should be submitted, one for grading and return to the student, the second for the use of shop supervisory personnel.

4. Project Report: After the completion of the project, a project final report will have to be submitted. It should clearly show the differences, if any, in schedule, cost, function and appearance, between the project as built, and the originally proposed version.

5. Work Samples: Samples of the project proposal and report will be furnished to all students as a guide and model for their work.

6. Grading: The grade for the course will be based on 7 components, each carrying equal weight. They are: 1. Homework, 2. Project Proposal, 3. Exam #1, 4. Exam #2, 5. Attendance, 6. Final Project and 7. Project Report.

7. Drawings, Proposal and Report: In designing the projects, careful and detailed sketches are encouraged, and rewarded especially if done on Autocad, Solidworks or WILDFIRE or similar CAD software packages. All reports should be typed.

8. Incomplete grades; there will be none given.

9. Laboratory Demonstrations: In the weeks indicated in the schedule, laboratory demonstrations will be given on Fridays. Questions are encouraged during the demonstrations, some of the problems and questions on the exams will deal with material covered in the demonstrations.

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FIRST EXAMINATION
December 7, 1941

NAME:_____

ID #:_____

PROBLEM	POINTS
1	_____
2	_____
3	_____
4	_____
5	_____
6	_____
7	_____
8	_____
9	_____
10	_____
	_____
TOTAL	_____

STATEMENT

This examination is my own work. I have not had access to anyone else's solution or notes for this exam, nor have I given anyone else access to my exam solution or notes.* I have not collaborated or discussed this exam with anyone** and I have neither received nor given any help in solving the problems I am submitting for grading.

_____
SIGNATURE DATE

* Anyone handing in another student's exam is deemed to have had access to that exam, if you cannot hand in your own exam, consult the instructor for advice.

** with the exception of the instructor.

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LAB DEMO SCHEDULE
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	Group I	Group II	Group III
JAN 27	MACHINING I BOB SJOSTROM	SOLIDWORKS PATRICK PEASE	DESIGN, R. PROTO* JOE ESTANO
FEB 3	DESIGN, R. PROTO* JOE ESTANO	MACHINING I BOB SJOSTROM	SOLIDWORKS PATRICK PEASE
FEB 10	SOLIDWORKS PATRICK PEASE	DESIGN, R. PROTO JOE ESTANO	MACHINING I BOB SJOSTROM
FEB 17	MACHINING II BOB SJOSTROM	CASTING KARA MOGENSEN	AUTOMATION GERRY SHEPPARD
FEB 24	NO LAB DEMOS POWER POINT PROPOSAL PRESENTATION		
MAR 2	AUTOMATION GERRY SHEPPARD	MACHINING II BOB SJOSTROM	CASTING KARA MOGENSEN
	TAKEHOME EXAM HANDED OUT, DUE MONDAY, MARCH 5		
MAR 9	CASTING KARA MOGENSEN	AUTOMATION GERRY SHEPPARD	MACHINING II BOB SJOSTROM
MAR 23	WELDING GERRY SHEPPARD	METALLOGRAPHY KARA MOGENSEN	SOLIDWORKS PATRICK PEASE
MAR 30	SOLIDWORKS PATRICK PEASE	WELDING GERRY SHEPPARD	METALLOGRAPHY KARA MOGENSEN
APR 6	METALLOGRAPHY KARA MOGENSEN	SOLIDWORKS PATRICK PEASE	WELDING GERRY SHEPPARD
APR 13	MACHINING III BOB SJOSTROM	HEAT TREATMENT KARA MOGENSEN	MATERIALS TESTING DAVID CAMPBELL
	PROJECT PRESENTATION 3-4PM		
APR 20	MATERIALS TESTING DAVID CAMPBELL	MACHINING III BOB SJOSTROM	HEAT TREATMENT KARA MOGENSEN
APR 27	HEAT TREATMENT KARA MOGENSEN	MATERIALS TESTING DAVID CAMPBELL	MACHINING III BOB SJOSTROM

LOCATIONS: ALL MACHINING DEMOS, BASEMENT, GUITAR CENTER BUILDING
WELDING AND CASTING DEMOS, ROOM 306, 730 COMM. AVE.
HEAT TREATMENT AND METALLOGRAPHY DEMOS, ROOM 308 "
SOLIDWORKS, ECL LAB, ROOM 125, 15 ST. MARY'S ST.
AUTOMATION: ADMS LAB 730 COMM. AVE. SECOND FLOOR
RAPID PROTOTYPING: BASEMENT, 110 CUMMINGTON ST
MATERIALS TESTING INSTRON ROOM 730 COMM AVE.

General Information

In order to bring current relevance to the teaching of engineering courses, to remain up-to-date on the state of the art of various technologies and to satisfy my own curiosity, I subscribe to and read(or scan) a number of publications. Some of these are available in my office for your use. If I am aware of the particular interests of some of my students, I look for and save copies of relevant, current articles about those interests. If you would like to indicate such interests to me on the appropriate line of your registration form for this course, I'll try to spot relevant articles and call your attention to them or provide you with copies for your use and information. Feel free to indicate your interest in a company, industry, technology, product line or one of the publications listed below. A partial list of publications follows.

Daily:

- The New York Times
- The Wall Street Journal
- The Boston Globe
- The Nashua Telegraph

Weekly:

- Time
- Newsweek
- Business Week
- Aviation Week*
- The New Yorker
- Fortune
- Forbes

Monthly:

- Popular Science*
- Popular Mechanics*
- Technology News(MIT)*
- The Atlantic*
- Car and Driver*
- Automotive Industries*
- Manufacturing Engineering*
- Mechanical Engineering*
- Marine News*
- Invention and Technology*
- Maritime Reporter*
- Road and Track*
- Marine Technology*
- Yachting*
- Outdoor Life*
- Field and Stream*
- American Rifleman *
- Guns and Ammo *

Sporadically:

- The Times(London)
- Der Spiegel
- International Herald Tribune
- Trout and Salmon

*Publications marked with an asterisk are routinely available in my office

1/20/2012

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CLASS LIST REGISTRATION

Note: This information and statement simply confirm your intention to attend this course, and your understanding of the syllabus, the grading policy and the honor system. It is strictly for the use of the instructor and the teaching assistant in the course. This information is necessary to list you on the grade sheet for the course. Since the official class lists are not available until well after the start of the semester, and even then are not always complete, you cannot be sure of being on the grade sheet until you have submitted this information.

NAME:_____

ID#:_____

MAJOR:_____

TERM PHONE #:_____*

e-mail address:_____*

SPECIAL INTERESTS_____

_____

* Listing your phone and/or e-mail address will allow us to get in touch with you in case of missed assignments or exams.

I acknowledge the receipt of the EK156 DESIGN AND MANUFACTURE syllabus for the SPRING 2012 Semester. I have read and I understand the grading policy and the dates of the exams. I have also read the sample exam cover and I understand the honor policy and the honor system statement which I am expected to sign with each exam in the course.

_____

SIGNATURE DATE