AMERICAN UNIVERSITY OF BEIRUT
MECH 200 Intro to Mechanical Engineering
AY 2015-16

Catalog Description:

This course induces students to self-learn. Important concepts such as creative design principles and reverse engineering are introduced. Being project-based, students are required to devise solutions to open-ended problems in the process of designing a micro-car. A combination of lectures and laboratories seeks to expose students to a realistic snap shot of the discipline of mechanical engineering including representative software & hardware tools typically utilized in mechanical engineering practices. In teams of four, students go about designing, analyzing, fabricating, and assembling their own micro-car with which they will compete at term's end in what is known as the Gee Wiz Micro-car contest.

The course specifically emphasizes product development by:

- identifying needs (Functional Requirements) and then devising practical solutions (Design Parameters) to fill those needs through (1) designing, (2) fabricating, (3) integrating, (4) and testing and evaluating of an **engineered product**.
- starting from a **requirement statement** -and working with a basic (common) tool kit- the student goes about developing a functional engineering prototype. All of this is accomplished as a **team** effort where teamwork experience and **communication** skills are highly stressed and are practiced through a term-end contest (**Micro-car Gee Wiz contest**).

Prerequisites: None
Required: yes
Lectures: Bechtel ALH, Fridays 10-10:50 am.

Coordinator: Prof. R. Hamade, Mech.Eng., Bechtel 418, ext. 3481.E-mail: rhamade@aub.edu.lb.
Instructors: Mr. Elie Kfoury
Mrs. Lina Kasssi
Mr. Abdel Kader Saidi

Prerequisites by topic

1. Basics of Physics.
2. Fundamentals of Mathematics: Calculus and Geometry.
3. Computer Literacy.
4. Team Work.

Topics

1. Introduction to Topics in Mechanical Engineering:
    - Integrated Product Development (IPD) methodology
    - Time Management and Project scheduling
    - Engineering Drawing & Computer-aided Design and Drafting (CADD)
    - Power & Power Transmission
    - Mechanical Design
    - Product Design Methodology
    - Fabrication and assembly
    - Materials in Design
    - Fundamental Dimensioning

2. Introduction to Mechanical Engineering Software:
    - Matlab (Engineering Analysis)
    - Creo Parametric 3D CAD (was Pro/Engineer)

Textbook
None required. Lecture notes will be posted on Moodle.

References

- *Engineering Fundamentals: an introduction to engineering*", Saeed Moaveni. Thomson. Second edition.
- *Reverse Engineering: An Industrial Perspective* Vinesh Raja (Editor), Kiran J. Fernandes, 2007, Springer, ISBN: 184628855X
- *Modeling with Creo Parametric 2.0,* Sridhar S. Condor, SDC Publications, 2013
- Class notes
- Library Resources
- Your Instructors
    a. MIT's 2.007 course site http://pergatory.mit.edu/2.007
    b. www.howthingswork.com
    c. www.sdp-si.com/Sdptech_lib.htm
    d. www.efunda.com/home.cfm
    e. http://pespmc1.vub.ac.be/DEFAULT.html
    f. http://precision.me.gatech.edu/class/me21110/
    g. www.InventorsDigest.com
    h. www.uspto.gov
    i. www.bobcat.com
    j. Also Engineering databases available at AUB: http://staff.aub.edu.lb/~webjafet/eresources/databases/engineering.html
    k. and many more sites!!!

Course Objectives
Upon completion of this course, the student will:

1. demonstrate competence in defining design objectives and understand the basis and criteria for design for manufacturing, assembly, safety, robustness and maintenance.
2. demonstrate ability to use ideation techniques to generate solution concepts that meet the design objectives.
3. demonstrate the ability to formulate and solve preliminary selection and decision problems that are appropriate to their design project. Students will be able to understand and make tradeoff decisions that are appropriate for their design project.
4. be able to formulate plans of action of a project, identify flows between activities, and will be able to schedule their plans of action.
5. will understand the role of engineering software packages and graphical databases in engineering design.
6. develop an awareness of challenges occurring in teamwork and demonstrate share responsibility among team members and teamwork in preparing design reports.
7. demonstrate the ability to describe engineering products and their function, describe alternatives, argue their merits and make recommendations.
8. be able to retrieve information and utilize available resources in their environment. They will develop awareness of various types of resources and their management.
9. understand leadership principles and understand the value of project management in an engineering environment.

Course Learning Outcomes

Objectives 1-9 cater for Outcomes (b), (c), (d), (f), (g), (h), (i) and (k) of ABET EC2000 Criterion 3

Outcome 1 (correlates to course objective 1)
Students will be able to analyze and understand the contest events' functional requirements (design objective) and translate this into a working engineering specification.

Outcome 2 (correlates to course objective 2)
Students will have to fabricate one mechanical component (e.g. shaft) from scratch as well as assemble components while building their Micro-cars.

Outcome 3 (correlates to course objective 3)
Students will have to make proper use of engineering formulae to make calculations of stress, torque, etc..

Outcome 4 (correlates to course objective 4)
Students will have to develop full schedules using Microsoft Project (or equivalent) in order to justify orderly progress of their project thus demonstrating proper time management skills.

Outcome 5 (correlates to course objective 5)
Students will have to use computer software tools (MATLAB) to solve engineering formulae in order to optimize designs.

Outcome 6 (correlates to course objective 5)
Students will be able to build solid CAD models and databases to describe their designs.

Outcome7 (correlates to course objective 6,9)
Students are able to work in teams of four based on their skilled tasks: manager, systems analyst, engineer, and detailed designer coherently in order to build and race their micro-car in the end-of-course competition (the Gee Whiz contest).

Outcome 8 (correlates to course objective 8)
Students will be able to use the common kit (motor, battery) as well as other necessary components in order to design, build, and race a successful Micro-car.

Outcome 9 (correlates to course objective 7)
Students will be able to produce a final comprehensive report as well as delivering a team presentation.

Outcome 10 (correlates to course objective 9)
Students will have full responsibility for their deliverables and therefore, the success or failure of their final contribution in the contest. One in four of all the students will actually function as leaders of their teams.

Contribution of Course to Meeting the Professional Component
Outcomes 1,3,4,5,6,7,9,10 contribute to mechanical engineering professional practices.

Assessment and Evaluation

1.	Lab Classwork	10% (Individual)
2.	Milestone Assignments	15% (Individual)
3.	Lecture Attendance	10% (Individual)
4.	Project Notebook	5% (Individual)
5.	Final Design Report	20% (Individual on Function)
6.	Team Presentation	10% (Individual on Function)
7.	Term-End's (GeeWiz) Contest	30% (Team Grade) Saturday 23-April

Software usage include
Use of a variety of computer software packages: MS Excel and Word and Project, Matlab, Creo (previously Pro/Engineer) CAD.

Hardware usage include
1. Variety of machine shop fabrication tools (Machining lathe, welding, sheet metal, casting, etc ..)

MECH200 LECTURE SCHEDULE:
Rev 1.0 January 26, 2016
Lectures are held in Engineering Lecture Hall

Date	WK	Lecture	Lecture Objectives	pre-lecture assignment	post-lecture assignment
29-Jan	**1**	***Lecture #1*** Discuss Syllabus Electric Micro car Gee Whiz contest. (Prof. Hamade)	1. Class syllabus & logistics. 2. Introduce class instructors and GA's. 3. Expected Outcomes. Introduce the Micro car Gee Whiz contest.	Study Lecture (will be posted on Moodle) Study Lecture (will be posted on Moodle)	Review Lectures 1-2 from MIT's 2.007 course placed in the ME Tool's course folder at the FEA Library
5-Feb	**2**	***Lecture #2*** Reverse Engineering (Prof. Hamade)		Study Lecture (will be posted on Moodle)	
12-Feb	**3**	***Lecture #3*** Integrated Product Development (IPD) methodology (Prof. Hamade)	Concurrent Engineering Phases: Concept, Engineering, Detailed Design, Manufacturing	Study Lecture (will be posted on Moodle)	Review Lectures 3-7 from MIT's 2.007 course placed in the ME Tool's course folder at the FEA Engineering Library
19-Feb	**4**	***Lecture #4*** Intr. To Automotive Engines (Mr. Elie Kfoury)	Principles of Vehicle Systems analysis and design	Study Lecture (will be posted on Moodle)	
26-Feb	**5**	***Lecture #5*** Introduction to Automotive Sub-systems (Prof. Daher)		Study Lecture (will be posted on Moodle)	
4-Mar	**6**	***Lecture #6*** Intro to vehicle design in the context of Gee Wiz (Prof. Hamade)		Study Lecture (will be posted on Moodle)	
11-Mar	**7**	***Lecture #*** 7 Intro to CAD_CAM_CAE (Prof. Hamade)		Study Lecture (will be posted on Moodle)	
18-Mar	**8**	***Lecture #*** 8 Introduction to Machine Elements (Power Transmission Gears) (TBD)		Study Lecture (will be posted on Moodle)	
25-Mar	**9**	***No lecture / Holiday***			
1-Apr	**10**	**Lecture #9** Introduction to Metal Fabrication (Prof. Hamade)	Metal working machine tools	Study Lecture (will be posted on Moodle)	
8-Apr	**11**	***Lecture #10*** Materials in Design (Prof. Hamade)	Materials families and selection	Study Lecture (will be posted on Moodle)	
15-April	**12**	***Lecture #11*** Dimensioning and Drawings (Prof. Hamade)		Study Lecture (will be posted on Moodle)	

24-Apr	**13**	

Reading period starts Friday May 08, 2015
Final Exams start Monday May 11, 2015

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MECH 200 LAB SCHEDULE:

Teams will be made up on the first week of the lab sessions (according to a questionnaire posted on Moodle).

Section	Lab Time
1	M 11:00-1:50
2	T 11:00-1:50
3	W 11:00-1:50
4	M 2:00-4:50
5	T 2:00-4:50
6	W 2:00-4:50
7	Th 11:00-1:50
8	F 2:00-4:50

Date	Sec	Week / Lab	Lab Activity	Pre-Lab	Class work	Post-Lab	Location
1-Feb	1	**Lab #1 Week 02** Library search (Mr. Khaled Noubani)	Library Search Lab	No Pre-Lab for first week	Y	Write a report (to be turned in AT END OF THE LAB SESSION) outlining the results of your Library Search Session.	IOEC 402 or SRB Computer Labs
2-Feb	2						
3-Feb	3						
1-Feb	4						
2-Feb	5						
3-Feb	6						
4-Feb	7						
5-Feb	8						
8-Feb	1	**Lab #2 Week 03** Reverse Engineering	• Reverse engineering presentation. • Reverse engineering of previous contest vehicle design from 2014-15. This includes reverse engineering exercise (laser scanning with Polyworks software of microcar chassis from last year). • Each group must perform analysis. PREPARE FORMAT. Explain about tools and tool boxes.	Each student should come with two different definitions of reverse engineering with the sources they got them from and submit them hard copy in class.	Y	• Car reverse engineering report. • Describe the physics behind the success and failure for the previous project.	SEA Formula1 Lab IOEC B1
9-Feb	2						
10-Feb	3						
8-Feb	4						
9-Feb	5						
10-Feb	6						
11-Feb	7						

12-Feb	8		• 4 page blank report to be filled in class, signed and dated				
15-Feb	1	**Lab #3 Week 04** MS Project	Introduction to scheduling and planning using Microsoft Project.	Go through online tutorials for Microsoft Project.	Y	MS Project Exercise to be submitted on Moodle.	IOEC 402 or SRB Computer Labs
16-Feb	2						
17-Feb	3						
15-Feb	4						
16-Feb	5						
17-Feb	6						
18-Feb	7						
19-Feb	8						
22-Feb	1	**Lab #5 Week 06** Engine Lab	Car engine shop (focus on transmission / clutch / steering / etc...)		N	Submit results obtained from tests and compare with the actual datasheet provided with motor	First 1.5 hours in IOEC B1 and second 1.5 hours in IOEC B2
23-Feb	2						
24-Feb	3						
22-Feb	4						
23-Feb	5						
24-Feb	6						
25-Feb	7						
26-Feb	8						
29-Feb	1	**Lab #4 Week 05** Car Design Strategy	MicroCar Design Strategy Session using sketches, etc..	• Obtain kit, includes 12 volts DC electric motor and a 12 volts battery. • Open Garage Sale (1ST COMES, 1ST SERVED).	Y	HW to be submitted on Moodle.	IOEC 402 or SRB Computer Labs
1-Mar	2						
2-Mar	3						
29-Feb	4						
1-Mar	5						
2-Mar	6						
3-Mar	7						
4-Mar	8						
7-Mar	1	**Lab #6 Week 07** MATLAB Lab Work	Introduction to MATLAB and car motion model		Y	MATLAB Exercise to be submitted on Moodle	SEA Formula1 Lab IOEC B1
8-Mar	2						
9-Mar	3						
7-Mar	4						
8-Mar	5						
9-Mar	6						
10-Mar	7						
11-Mar	8						
14-Mar	1	**Lab #7 Week 08** Computer-Aided Design & Drafting I	Intro to Creo Parametric 3.0 Design and Drawing		Y	CREO Exercise to be submitted on Moodle	IOEC 402 or SRB Computer Labs
15-Mar	2						
16-Mar	3						
14-Mar	4						
15-Mar	5						
16-Mar	6						
17-Mar	7						

18-Mar	8						
21-Mar	1	**Lab #8 Week 09** Computer-Aided Design & Drafting II	Intro to Creo Parametric 3.0 Advanced Parts + Assembly and Drawing		Y	CREO Exercise to be submitted on Moodle	IOEC 402 or SRB Computer Labs
22-Mar	2						
23-Mar	3						
21-Mar	4						
22-Mar	5						
23-Mar	6						
24-Mar	7						
25-Mar	8						
28-Mar	1	**Lab #9 Week 10** Fabrication Processes	Intro to machining operations: (1) Bench work, (2) Drilling, and (3) Turning	• Wear clothes according to dress code provided on Moodle. • Study the 2 drawings (Model) to be machined in the Shop.	Y		Machine Shop (Below Ground SRB)
29-Mar	2						
30-Mar	3						
28-Mar	4						
29-Mar	5						
30-Mar	6						
31-Mar	7						
1-Apr	8						
4-Apr	1	**Lab #10 Week 11** Car Fabrication	Fabricate the contest micro-car at the shops	• Deliver final detailed drawings of shaft with YOUR drawing / documentation. • Deliver the completed car during week of April 18.	N		Machine Shop (Below Ground SRB)
5-Apr	2						
6-Apr	3						
4-Apr	4						
5-Apr	5						
6-Apr	6						
7-Apr	7						
8-Apr	8						
11-Apr	1	**Lab #11 Week 12** Car Fabrication	Fabricate the contest micro-car at the shops	Deliver the completed car during week of April 18.	N		Machine Shop (Below Ground SRB)
12-Apr	2						
13-Apr	3						
11-Apr	4						
12-Apr	5						
13-Apr	6						
14-Apr	7						
15-Apr	8						
18-Apr	1	**Lab #12 Week 13** Car Fabrication	• Individual notebook due • Final report due • Team Project Presentations • Complete car build (must demo during presentation) • Turn car in for safekeeping until Thursday 21st contest day at 5 pm!!!!	• Prepare Powerpoint Team Project Presentations. • Deliver Individual notebook for grading. • Deliver final report.	Y (car)	Integrate and test your car prototype in anticipation for contest	IOEC 402 or SRB Computer Labs
19-Apr	2						
20-Apr	3						
18-Apr	4						
19-Apr	5						
20-Apr	6						
21-Apr	7						

Friday 22- April Presentations Day (please preschedule on Moodle)
Saturday 23-April Gee Whiz Contest Day

Reading period starts Tuesday May 03, 2016

Expected Micro-Car Hardware fabrication

- Standard electric motor (will be given to you)
- Design of the shaft to be turn-able (to be made at AUB machine shop)
- Sand cast-able components (to be made at AUB machine shop)
- Sheet metal / wood box (to be made at AUB machine shop)

Students expect the instructor to:

- Respect all students.
- Be fair in grading.
- Provide leadership.
- Be committed to teaching and advising.
- Provide encouragement rather than discouragement.
- Clearly define course requirements and the grading algorithms.
- Balance course workload with credit hours.
- Schedule office hours and be available to help.
- Provided candid and timely feedback on assignments.
- Arrive before the scheduled class time and prepare the classroom.

Instructors expect the student to.

- Show respect to everyone involved in the program.
- Be responsible for your own progress and learning.
- Be dedicated to understanding and learning.
- Stay current with materials and issues covered in class.
- Be a positive and creative team member.
- Be inquisitive and compete within the framework of a team.
- Be interested in engineering and product design.
- Attend class or notify the instructor in advance if you intend to be absent.
- Arrive on time for class with a positive attitude.

"If you have documented special needs and anticipate difficulties with the content or format of the course due to a physical or learning disability, please contact me and/or your academic advisor, as well as the Counseling Center in the Office of Student Affairs (Ext. 3196), as soon as possible to discuss options for accommodations. Those seeking accommodations must submit the Special Needs Support Request Form along with the required documentation."