Mechanical Design II
MCHE 411– Spring 2015-2016
Read this course outline intently!

What you learn can never hurt you and no one can take away from you… Learn and fulfill your life's purpose!

Course/Instructor Information

Course Code & Title	MCHE 411 – Mechanical Design II (3 Credits: 3 Lec, 0 Lab)		
Section 1 – CRN 20140	MW 8:00 – 9:30 Room: B211 (Science)		
Section 2 – CRN 20141	TTh 11:00 – 12:30 Room: B211 (Science)		
I-Connect Link	http://iconnect.bau.edu.lb/		
Instructor Name	Semaan Amine	**Office**	G120
Phone	3417	**Email**	s.amin@bau.edu.lb
Office Hours	TTh 8:00 – 9:30, 12:30 – 2:00, otherwise by appointment		
Term/Year	Spring 2015-2016		

COURSE DESCRIPTION

COURSE-IN-BRIEF
This course aims to introduce the design of various machine components for rigidity and strength and to integrate this knowledge in the design of task-specific power transmission systems. Student teams will be required to design and build a prototype of a power transmission system. In the process students will blend concepts learned in the course with knowledge they acquire through independent research as they encounter unfamiliar issues.

Specific topics covered include: Design of clutches, brakes and couplings, Design of friction elements, Design of gears and gear trains, Design of gears for strengths using AGMA standards. Selection of rolling bearings, Lubrication and design of journal bearings, Design of power transmission systems, Computer-aided applications, Team project to formulate, design and build a mechanical system for a useful purpose.

PREREQUISITES BY TOPIC
- Strength of Materials
- Dynamics of Machinery
- Computer programming

COURSE READING AND RESOURCES
Resources for the course include the instructor, textbook and references; class notes and handouts; your teammates; the library; products catalogues; the web.

OFFICE HOURS
Support is always available for those who seek it. You are encouraged to come into my office, during office hours, and ask questions, consult, provide feedback, or give suggestions.

Please take full advantage of the office hours. Students are encouraged to send me enquiries by email at s.amin@bau.edu.lb *or via I-connect at* http://iconnect.bau.edu.lb/.

TEXTBOOK

- R. Budyans and K. Nesbit, *Shigley's Mechanical Engineering Design*, 9th Edition, McGraw-Hill, 2010.

REFERENCES

- R. C. Juvinall and K. M. Marshek, Fundamentals of Machine Component Design, 5th Ed., Wiley, 2011.
- R. L. Mott, Machine Elements in Machine Design, Prentice Hall, 4th Ed., 2003.
- W. C. Young, R. Budynas and A. Sadegh, *Roark's Formulas for Stress and Strain*, McGraw-Hill, 8th Ed., 2011.
- W. H. Middendorf, *Design of Devices and Systems*, Marcel Dekker, Second Edition, 1989.
- J. N. Siddal, *Optimal Engineering Design: Principles and Applications*, Marcel Dekker, 1982.
- D. G. Ullman, *The Mechanical Design Process*, McGraw-Hill, 4th Ed., 2009.
- AGMA 218.01, *AGMA Standard for Rating the Pitting Resistance and Bending Strength of Spur and Helical Involute Gear Teeth*, December 1982.
- E. Oberg, F. D. Jones and H. L. Horton, *Machinery's Handbook*, 23rd Ed., Industrial Press, 1988.
- J. E. Shigley, C. R. Mischke, and T. Brown, *Standard Handbook of Machine Design*, McGraw-Hill, 3rd Ed., 2004.
- R. L. Norton, *Machine Design: An Integrated Approach*, Prentice Hall, 3rd Ed., 2005.
- A.D. Deutschman, W. J. Michels and C.E. Wilson, *Machine Design - theory and practice*, Macmillan Publishing Company, 1975.
- T. Byers, R. Dorf, and A. Nelson, *Technology Ventures*: From Idea to Enterprise, McGraw-Hill, 3rd Ed., 2010.

ELECTRONIC RESOURCES

Open Course Ware form MIT: ocw.mit.edu
Open Content Website from UC Berkeley: webcast.berkeley.edu
Library of Congress**:** www.loc.gov/library/libarch-digital.html
Machine Design magazine: machinedesign.com
Power Transmission Magazine: powertransmission.com

RECOMMENDED READING RESOURCES

- S. C. Florman, *The civilized Engineer*, St. Martin's Press, 1983
- S. C. Florman, *The Introspective Engineer*, St. Martin's Press, 1996
- M. Dertouzos, *What Will Be*, Harper Collins, 1997
- U. S. Department of Commerce, *The Emerging Digital Economy*, 1998
- P. E. Plsek, *Creativity, Innovation, and Quality*, American Society of Quality, 1997
- R. Wenderlich, *The ABC's of Successful Leadership: Proven, Practical Attitudes, Behaviors and Concept Based on Core Values That Result in Successful Leadership*, Success Builders Inc, 1997

TOPICS

The subject matter for this course includes the material in Chapters 11-18 of the textbook and additional material in the form of lecture notes and handouts to cover the following topics:

Week no.	No. of weeks	Topic covered	Chapter no.
1	0.5	Introduction to power transmission systems	-
1	1	Law of gearing and gear terminology	13
2	1	Analysis and synthesis of gear trains	13
3	1.5	Gear force analysis	13
5	2	Design of gears for strength using AGMA standards for: spur, helical, bevel, and worm gears	14,15
7	3.5	Design and Selection of various types of bearings	11,12
10	0.5	Computer-aided applications	-
11	2	Design of belts and chain drives	17
13	1.5	Design of clutches, brakes and couplings	16
14	0.5	Design of Power transmission systems	18
15	0.5	Machine design optimization	-

EDUCATIONAL AIMS

The aim of this course is to develop student's knowledge and ability to:

- Design power transmission systems for a specific task,
- Determine basic bearing dynamic load rating to select appropriate rolling element bearing,
- Apply the theory of lubrication to design hydrostatic, squeeze film, and journal bearings,
- Design gears for strength using AGMA Standards,
- Design of belt and chain drives,
- Develop key performance skills of team work and communication,
- Understand the mechanical design process and the intricate details it entails in transforming a design idea into a physical reality.

INTENDED LEARNING OUTCOMES

At the end of this course, the student is expected to:

1. Know the basic elements and practical considerations in power transmission design;
2. Select rolling element bearings;
3. Design journal bearings using lubrication theory;
4. Apply AGMA standards to design gears for strength;
5. Design of flexible elements – belts, chains, and cables;
6. Use CAD software to model and design a mechanical system;
7. Experience teamwork activities and improve interpersonal skills;
8. Write report to enhance written communications skills.

HOMEWORK & PROJECT

HOMEWORK

Rationale. Homework is one of the most effective means of learning. Homework learning tool helps students apply theories and concepts they learn and enhance their problem solving and thinking skills. A student giving serious attention to solving problems in due time is like a farmer obeying the "law of the harvest"; affording the right care for the farm at the right moment.

Policy. In this course, homework problems will be assigned in conjunction with lecture topics as incremental learning tool. Due dates of assignments will be announced at appropriate times. Each set of homework problems will be collected for grading. The solution of each problem in a set is a reflection of understanding of the subject matter. So, a solution must be logically organized and neatly presented. It must also include the problem statement, all pertinent solution steps, equations used, assumptions made, legible supporting graphs, and boxed answers with proper units. Use only one side of a sheet and start the solution of a new problem on a new page. Graded homework with comments will be returned a week after it is collected.

PROJECTS-BASED LEARNING

Rationale. Research has shown that project-based learning that involves teamwork and hands-on exploration engage students in the material learned, motivate them, help them gain insights into the concepts, and give them a chance to integrate the pieces of knowledge and experience systems level thinking.

Project. The course will involve a meaningful, team-oriented project that culminates in a report, presentation, and possibly a devise on a specific design-related area.

IT USAGE

Students are expected to solve homework problems using Excel and/or Matlab. Students will also be required to use Web tools and resources such as YouTube, etc. to gain knowledge on various power transmission issues.

COURSE POLICIES

CLASS ATTENDANCE

Rationale. Attending class indicates a sense of responsibility and willingness to learn. Research has shown that attending classes, asking good questions, participating in class discussion, and submitting assignments and projects on time results in a better student's performance.

Policy. Attendance is required! Please be in class on time. Attendance will be taken at the beginning of each class period. In case you are not present when attendance sheet is passed on, you will be marked absent. If you are late for more than 10 minutes you will not be allowed into the classroom not to cause distraction. You will receive a first warning if you miss more than 3 classes and shall be dismissed from the course if you miss more than 6 classes.

CLASS DISCUSSION

Rationale. Active participation in classroom discussions, asking questions, and answering them gives life to a classroom and drives learning. Positive communication between the students and the instructor in the classroom and outside through various means such as Moodle, email, and twitter impacts students' learning positively.

Policy. Feel free to voice your opinions and ask questions anytime during a class period. Practice your right and freedom to learn. Remember you are here to learn and we are here to teach and that teaching and learning are forever intertwined. You can help me teach you as much as I can help you learn. Be an active participant in the learning process and recognize that it takes a team effort to realize meaningful things in life.

HELP SESSIONS

Help sessions will be organized at convenient times as needed upon request from students.

MAKE-UP TESTS AND LATE HOMEWORK POLICY

NO makeup test will be given and late assignments or project will not be accepted unless the reason is beyond the student's control and penalty is likely to be applied. *Do not abuse the use of excuses because in the end it is of no use*!

EXPECTED BEHAVIOR

Practicing engineers are expected to conduct themselves in an ethical and professional manner. This includes attending all class activities; meeting deadlines; observing common courtesies to fellow students, teachers, and staff; being honest; making a diligent effort to learn; and does not engage in any disruptive irresponsible manner. Legitimate collaboration is encouraged but academic collusion or dishonesty will not be tolerated.

GENERAL POLICIES

The student must understand his/her rights and responsibilities that are posted on Bulletin Boards, and is urged to become familiar with all University policies that relate to conduct, appeals, exams, and course management. These policies are available in the Students' manual and on the University website http//:www.bau.edu.lb/students/. For inquiries about these policies the student should refer to the course instructor and faculty advisor.

EMAIL COMMUNICATIONS

An email listserve has been created for all students and for each of the programs to notify students of relevant information. Students are expected to check their BAU email accounts at least once a day for information regarding their courses, programs and events.

ASSESSMENT AND EVALUATION

Many aspects of the course will receive on-going, real-time assessments and feedback to help improve students' performance. This will be done by discussing performance in class and by arranging individual meetings.

Assessment in the following areas will be converted to points, to compute your final grade in the course:

Assessment Item	Marks
Homework	10%
7^{th} week assessment	20%
12^{th} week assessment	20%
Final Exam	40%
Team Project	10%

Note: *All of the required course-specific written reports/assignments will be assessed not only on their technical/academic merit, but also on the communication skills exhibited through them.*