



## MCHE 412 – Dynamic Systems, Modeling Course Outline – Spring 2015-2016

### Course/Instructor Information

<b>Course Code &amp; Title</b>	MCHE 412 – Dynamic Systems, Modeling & Analysis (3Crs: 3Lec)		
<b>Section 1 – CRN 20142</b>	TTh 9:30 – 11:00	Room: B229 (Engineering)	
<b>Section 2 – CRN 20143</b>	TTh 2:00 – 3:30	Room: B211 (Science)	
<b>i-connect Link</b>	<a href="http://iconnect.bau.edu.lb/">http://iconnect.bau.edu.lb/</a>		
<b>Instructor Name</b>	Semaan Amine	<b>Office</b>	G120
<b>Phone</b>	3417	<b>Email</b>	s.amin@bau.edu.lb
<b>Office Hours</b>	TTh 8:00 – 9:30, 12:30 – 2:00, otherwise by appointment		
<b>Term/Year</b>	Spring 2015-2016		

### COURSE DESCRIPTION

#### COURSE-IN-BRIEF

The course presents an introduction to dynamic modeling of mechanical, electrical, and mixed discipline systems. Student teams will be required to model, analyze and simulate a dynamic system. In the process, students will blend concepts learned in the course with knowledge they acquire through independent research.

Specific topics covered include: modeling of various mechanical systems and electrical networks, linear and non-linear systems, time- and frequency-response analysis, nonlinear systems, introduction to dynamic systems design and control. The course also includes a team project in which teams are required to model and simulate a dynamic system.

#### PRE-REQUISITES BY COURSE

- MCHE 213: Dynamics.
- POWE 112: Electric Circuits.

#### COURSE READING AND RESOURCES

Resources for the course include the instructor, textbook and references; class notes and handouts; your teammates; the library; the web.

#### TEXTBOOK

- C.C. Close, D.K. Fredrick, J.C. Newell, *Modeling and Analysis of Dynamic Systems*, 3<sup>rd</sup> Edition. New York, NY: John Wiley & Sons, Inc., 2001.

#### REFERENCES

- C.C. Close, D.K. Fredrick, *Modeling and Analysis of Dynamic Systems*, 2<sup>nd</sup> Edition. New York, NY: John Wiley & Sons, Inc., 1995.
- R.C. Dorf, R.H. Bishop, *Modern Control Systems*, 11<sup>th</sup> Edition. Prentice Hall, 2008.
- N.S. Nise, *Control Systems Engineering*, 6<sup>th</sup> Edition. New York, NY: John Wiley & Sons, Inc., 2011.

#### TOPICS

The subject matter for this course includes materials in the form of lecture notes and handouts to cover the following topics:

Week no.	No. of weeks	Topic covered	Chapter no.
1	1	Introduction: Dynamic systems, Input/output, Response, System components	1
2-3	2	Translational mechanical systems	2
4	1	Rotational mechanical systems	5
5-6	2	Solutions of linear models	7
7-8	2	Transform function analysis	8
9	1	Developing a linear model	9
10-11	2	State-space models	3,4
12-13	2	Electrical and electromechanical systems	6,10
14-15	2	Thermal and fluid systems	11,12

**INTENDED LEARNING OUTCOMES**

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

- Describe the basic components and concepts in dynamic systems;
- Develop linear models for translational & rotational mechanical systems, electrical & electromechanical systems and thermal & fluid systems;
- Solve for the response of a dynamic system via analytical methods and Laplace transform techniques;
- Develop state-space models;
- Simulate a linear dynamic system model using Matlab and SIMULINK;
- Linearize and analyze non-linear models;
- Develop linear models for electrical & electromechanical systems;
- Develop linear models for thermal & fluid systems.

**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.

**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

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

Assessment Item	Marks
<i>Assignments</i>	10 %
<i>7<sup>th</sup> week assessment</i>	25 %
<i>12<sup>th</sup> week assessment</i>	25 %
<i>Final Exam</i>	40 %

**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.*

#### Prepared by / Date

Semaan Amine, January 2014

#### Revised by / Date

Semaan Amine, January 2016