SYLLABUS

Course Code	*Course Num.*	*Course Name*	*Credit Hours*	*Lec.*	*Lab.*	*Tut.*	*Private study*	*Pre-requisites*	*Course Level*	*Teaching Language*
MAT	**463**	**Modeling and Simulation**	**4**	**2**	**2**	**1**	**7**	**MAT333 MAT434**	**8[1]**	**English**

A. Course Description

This course provides an introduction into modeling and simulation approaches and basic concepts of computation, covering methods and mathematical tools, modeling continuous and discrete systems and modeling with partial differential equations. Students will use MATLAB to explore a range of programming and modeling concepts. They will analyze one of a variety of scientific problems by designing a representative model, implementing the model, completing a verification and validation process of the model, and changing the model to reflect corrections, improvements and enhancements.

B. Course Outcomes

At the end of this course the student will be able to:

- Analyze, design and begin to control rigorous mathematical models in continuous and discrete approaches.
- Use processes undertaken to get a suitable mathematical model.
- Apply the fundamental analytical techniques and simulation methods used to develop insight into system behaviour.
- Apply master simulation techniques using Simulink\Matlab software.

C. References

Required Textbook

- *Mathematical Modeling and Simulation: Introduction for Scientists and Engineers,* Kai Veltn, Wiley 2009.
- *Introduction to Simulink® with Engineering Applications,* Steven T. Karris, Orchard Publications, 2006.

Other references:

- *Simulation Modeling and Analysis with Expert fit Software,* Averill Law, McGraw-Hill Science, 2007.
- *A Concrete Approach to Mathematical Modelling,* M. M. Gibbons, Wiley-Interscience, 2007.

Course Website: Google Classroom Webpage: http://www.imamm.org/

[1] *B.Sc. in Applied Mathematics.*

D. Topics Outline

1. **Introduction to Mathematical Modeling Process:** Concept, Objectives, Methods and tools Mathematics is the natural modeling language, Definition of mathematical models.
2. **Modeling Continuous Systems:** Modeling with Differential Equations: Population dynamic, Electrical Circuits, Mechanical Systems, Biological models (Lotka-Volterra systems, Predator-Prey systems).
3. **Modeling with Partial Differential Equations:** Linear Temperature Diffusion, One-dimensional Hydrodynamic model. Case Studies: Heat diffusion, Wave vibration, Laplace Equation.
4. **Modeling Discrete Systems:** Modeling with difference equations, Modeling with data, Discrete Velocity Models, Continuous Vs. Discrete Models
5. **Simulation:** Block-Diagrams, State-Space Model, Transfer Functions, State-space Vs. transfer function, Stability and pole locations, Introduction to Matlab\Simulink (Starting Simulink, Basic Elements, Building a System, Running Simulations), Simulation of some models (case study models) and Analysis of Simulation results.

E. Office Hours

Office hours give students the opportunity to ask in-depth questions and to explore points of confusion or interest that cannot be fully addressed in class.

F. Exams & Grading System

The semi-official dates of the exams for this course are:

- **Midterm 1:** 6th or 7th week.
- **Midterm 2:** 11th or 12th week.
- **Quizzes & Homeworks:** During the semester.
- **Final Exam:** 16th week.

Your course grade will be based on your semester work as follows:

Midterm: 20 %	**Lab Exam:** 20 %	**Final Exam:** 40 %
2 Quizzes, 4 Homeworks, Attendance & Participation: 20 %		

The grading distribution:

A+	A	B+	B	C+	C	D+	D	F
[95, 100]	[90, 95)	[85, 90)	[80, 85)	[75, 80)	[70, 75)	[65, 70)	[60, 65)	[0, 60)

G. Student Workload:

#	Teaching/learning activities	Contact Hours	Frequency	Total Contact hours	Self-study hours	Total self-study hours	Student Learning Time
1	Lecture	2	15	30	1	15	45
2	Tutorial	1	15	15	1	15	30
3	Lab\Practical	2	15	30	2	30	60
4	Homework	0	4	0	1	15	15
5	Quiz	0.25	2	0.5	1	2	2.5
6	Test (Midterm)	1.5	2	3	6	12	15
7	Final Exam	2	1	2	12	12	14
Total				**80.5**		**103**	**183.5**

Independent self-study = 103/15 ≅ 7 hrs per week

H. Student Attendance/Absence

Only three situations will be considered as possible excused absences:

- Occurrence of a birth or death in the immediate family will be excused. ("Immediate family" is defined by the University as spouse, grandparents, parents, brother, or sister).
- Severe illness in which a student is under the care of a doctor and physically unable to attend class will be excused. Students are not excused for a doctor's appointment. Do not make appointments that conflict with rehearsals. Notes from the University Health Center will be accepted.

Executive Rules for Study Regulations and Exams
goo.gl/ykm7t3