COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
MODELING AND ANALYSIS OF CHEMICAL ENGINEERING SYSTEMS	**CHBE 512**	**1-2**	**2 + 2**	**3**	**10**

Prerequisites	NONE

Language of Instruction	English
Course Level	Ph. D. Degree (Third Cycle Programmes)
Course Type	Compulsory
Course Coordinator	
Instructors	Assoc. Prof. Betül Ünlüsü
Assistants	
Goals	The aim of this course is to provide students with the ability to model chemical engineering systems and solve model equations using analytical and numerical techniques.
Content	Modeling and mathematical formulation of lumped-parameter and distributed-parameter systems encountered in chemical engineering. Analytical and numerical methods used in the solution of ordinary and partial differential equations.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Gains the ability to derive models for chemical engineering systems in a hierarchy of levels from the simplest to the most complex using the fundamental laws of physics	1	1,2	A,C
2) Acquires the ability to solve ordinary and partial differential model equations using analytical and numerical techniques	1	1,2	A,C
3) Gains the ability to communicate effectively in English	8	1,2	A,C

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study

Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	MODELING OF CHEMICAL ENGINEERING SYSTEMS (MASS, MOMENTUM AND ENERGY CONSERVATION EQUATIONS)	Textbook
2	MODELING OF CHEMICAL ENGINEERING SYSTEMS (MASS, MOMENTUM AND ENERGY CONSERVATION EQUATIONS)	Textbook
3	ANALYTICAL SOLUTION METHODS FOR ORDINARY DIFFERENTIAL EQUATIONS (FIRST ORDER LINEAR AND NONLINEAR EQUATIONS)	Textbook
4	ANALYTICAL SOLUTION METHODS FOR ORDINARY DIFFERENTIAL EQUATIONS (SECOND ORDER LINEAR AND NONLINEAR EQUATIONS)	Textbook
5	ANALYTICAL SOLUTION METHODS FOR ORDINARY DIFFERENTIAL EQUATIONS (METHOD OF FROBENIUS)	Textbook
6	ANALYTICAL SOLUTION METHODS FOR ORDINARY DIFFERENTIAL EQUATIONS (BESSEL'S EQUATION)	Textbook
7	MIDTERM EXAM I	Textbook
8	ANALYTICAL SOLUTION METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS (METHOD OF COMBINATION OF VARIABLES)	Textbook
9	ANALYTICAL SOLUTION METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS (METHOD OF SEPARATION OF VARIABLES)	Textbook
10	ANALYTICAL SOLUTION METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS (METHOD OF LAPLACE TRANSFORMATION)	Textbook
11	ANALYTICAL SOLUTION METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS (METHOD OF LAPLACE TRANSFORMATION)	Textbook
12	NUMERICAL SOLUTIONS OF DIFFERENTIAL EQUATIONS	Textbook
13	NUMERICAL SOLUTIONS OF DIFFERENTIAL EQUATIONS	Textbook
14	MIDTERM EXAM II	Textbook

RECOMMENDED SOURCES	
Textbook	RICE, R. G., DO, D. D., APPLIED MATHEMATICS AND MODELING FOR CHEMICAL ENGINEERS, 2nd ED., WILEY, 2012
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	63
Assignment	6	37
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	Understand and apply fundamental sciences, mathematics and engineering sciences at high level.					+	

2	Have a wide and deep knowledge in his/her field including the latest progresses.					
3	Reach the latest knowledge in the field and through its comprehension possess high level competence in required methods and skills for doing research.					
4	Ability to do an extensive study which brings novelty to science and technology, develop a new scientific method or technological product/process, or apply a known method to a new field.					
5	Understand a genuine research process independently, design, apply and carry through; manage this process.					
6	Contribute to science and technology literature by publishing the outcomes of his/her academic studies in prestigious media.					
7	Able to do critical analysis, synthesis and evaluation of ideas and progresses in his/her specialization.					
8	Able to communicate and discuss at high level orally, written and visually by using a language at least at the level of European Language Portfolio B2 orally and written.			+		
9	Able to communicate with persons in his/her career and widely with scientific and social ensemble orally and writtten.					
10	Able to evaluate scientific, technological, social and cultural developments and transfer them to society with senses of scientific disinterest and ethical responsibility.					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Including the exam week: 16x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	10	140
Mid-terms	2	4	8
Ödev	6	8	48
Final examination	1	5	5
Total Work Load			243
Total Work Load / 25 (h)			9.72
ECTS Credit of the Course			10