COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
ADVANCED CHEMICAL AND BIOLOGICAL REACTION ENGINEERING	CHBE 562	1	3 + 0	3	10

Prerequisites	-

Language of Instruction	English
Course Level	MS (Second Cycle Programmes)
Course Type	Elective
Course Coordinator	Prof. Dr. Mustafa Özilgen
Instructors	
Assistants	
Goals	Enabling graduate engineering students carry out modeling studies by employing advanced chemical engineering kinetics knowledge to biological and chemical data
Content	Mathematical modeling (transport phenomena, analogy and empirical models, 80 % -20 % rule), review of priciples of mathematical modeling as applied to kinetics of biological and chemical systems and reactor design. Biological reactor design , product formation, growth and sterilization models. Affect of axially dispersed plug flow analysis in biological and chemical reactor efficiency

Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Mathematical modeling		1,2, 3, 9, 12	A,C
2) Why do the chemicals react: theoretical aspects, data analysis, reliability of data		1,2, 3, 9, 12	A,C
3) Microbial kinetics: Metabolic engineering, growth product formation, sterilization models		1,2, 3, 9, 12	A,C
4) Overview of ideal reactor design		1,2, 3, 9, 12	A,C
5) Real reactor analysis in terms of series and parallel reactor systems with chemical and biological applications		1,2, 3, 9, 12	A,C

6) Non ideal reactor design with emphasis on axially dispersed flow		1,2, 3, 9, 12	A,C

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Discussion, 9: Simulation, 12: Case Study + simulation of the literature data from refereed articles
Assessment Methods:	A: Testing, C: Homework

COURSE CONTENT

Week	**Topics**	**Study Materials**
1-2	Mathematical modeling	
3-6	Why do the chemicals react: theoretical aspects, data analysis, reliability of data	
7-8	Microbial kinetics: Growth product formation, sterilization models	
9-10	Overview of ideal reactor design	
11-12	Real reactor analysis in terms of series and parallel reactor systems with chemical and biological applications	
11-12	Real reactor analysis in terms of series and parallel reactor systems with chemical and biological applications	
13	Discussion and presentation of the student projects	
14	Non-ideal reactor design with emphasis on axially dispersed flow	
15-16	General Revision and discussion, case studies, crititisim of literature	

RECOMMENDED SOURCES

Textbook	Özilgen M. Handbook of food process modeling and statistical quality control, 2nd ed. Taylor & Francis, USA, 2011
Additional Resources	Instructors refereed publications and presentations in international symposia

MATERIAL SHARING

Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	10 x 2
Homeworks	2	5 x2
Term project	1	70
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION (turned in as a project) TO OVERALL GRADE		70
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		20
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Acquire expanded and in-depth information via performing scientific research in the field of Chemical Engineering, evaluate, interpret and implement knowledge.					x
2	Be knowledgable in the contemporary techniques and methods applied in Chemical Engineering and their respective constraints.					x
3	Be cognizant of the novel and developing applications of his/her profession, study and learn them as required.					x
4	Formulate Chemical Engineering problems, develop methods to solve them and implement innovative techniques in solutions					x
5	Design and conduct analytical modeling and experimental research, analyze and interpret complex problems encountered in this process.					x
6	Develop novel and/or original ideas and methods; conceive innovative solutions in systems, component and process design					x
7	Complete information via processing limited or incomplete data by the use of scientific methods and implement it; integrate knowledge from different disciplines					x
8	Communicate in at least one foreign language at the level of European Language Portfolio B2 orally and in writing.					
9	Communicate stages and results of his/her studies in a systematic and clear manner orally or in writing in intra or interdisciplinary national and international					

	settings.					
10	Defines societal and environmental aspects of Chemical Engineering applications					x
11	Observe social, scientific and ethical values during collection, interpretation, and dissemination of data and in all professional activities.					
12	Lead multidisciplinary teams, develop solution methodologies for complex problems and take responsibility					x

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)	16	3	48
Hours for off-the-classroom study (Project)	16	8	128
Mid-terms	2	10	20
Quiz	2	5	10
Homework	1	20	20
Final examination	1	15	15
Total Work Load			241
Total Work Load / 25 (h)			
ECTS Credit of the Course			10