1. Course Description

COURSE DESCRIPTION FORM	
Course Code and Title	CHE478DYNAMIC SIMULATION AND CONTROL OF CHEMICAL PROCESSES
Course Semester	8
Catalog Description (Content) of the Course	The simulation of dynamic systems behaviour by using computer. The examples for rection engineering, thermodynamics, fluid dynamics, heat transfer, mass transfer and seperation processes. The investigation of laplace and time domain dynamics. Feedback controllers and the application examples for the different control systems.
Main Textbook	Control System Design using MATLAB, B. Shahian, M. Hassul, Prentice-Hall Inc.,1993.
Supporting Textbooks	Process Dynamics: Modeling, Analysis and Simulation, W.Wayne Bequette, Prentice -Hall, 1998. Brian Roffel and Ben Betlem, Process Dynamics and Control: Modeling for Control and Prediction, John Wiley & Sons Ltd, Chichester, 2006. Harold Klee and Randal Allen, Simulation of Dynamic Systems with MATLAB and Simulink, Second Ed., ,CRC Press, Prentice Hall Group, New York, 2011. Rao.,V. Dukkipati, Solving Engineering System Dynamics Problems with Matlab, New Age International Press Limited Publ., New Delhi, 2007. Steven E. LeBlanc and Donald R. Coughanowr ,Process Systems Analsysis and Control, Third Ed.,Mc Graw Hill , Higher Edecation, Ney York, 2009. J. Ingham, I. J. Dunn, E. Heinzle, J. E. Prenosil, J. B. Snape, Chemical Engineering Dynamics: An Introduction to Modelling and Computer Simulation, 3. Edition, Wiley-VCH Verlag GmbH & Co., Weinheim, 2007.
Course Credit (ECTS)	4
Prerequisites of the Course (Compulsory attendance should be indicated here.)	There is no prerequisite or co-requisite for this course.
Type of the Course	Technical Elective
Instruction Language of the Course	English
Object and Target of the Course	To teach computer aided simulation of physical and chemical systems, to gain the skill of combine a controlled process with simulation.
Learning Outcomes of the Course	Understanding of development of mathematical models to describe chemical process dynamic behavior. Understanding of mathematical methods applied to engineering problems using chemical engineering examples. Understanding of analytical and computer simulation techniques for the solution of ordinary differential equations. Understanding of dynamic behavior of linear first- and second-order systems. Understanding of process control and dynamics of controlled systems. Understanding of the difference between steady-state and non-steady behaviour Understanding the role in simulation of mathematical models uses

<table>
<tr><td></td><td>in Chemical Engineering
Recognising the effects of linear systems parameters on system responses, including system stability.
Understanding of basics of using SIMULINK to perform simulations of dynamic systems.</td></tr>
<tr><td>Mode of Delivery</td><td>The mode of delivery of this course is Face to face</td></tr>
<tr><td>Weekly Schedule of the Course</td><td>
<table>
<tr><th>Week</th><th>Subject</th></tr>
<tr><td>1</td><td>Introduction to Process Modeling</td></tr>
<tr><td>2</td><td>Process Modeling Fundamentals and Extended Analysis of Modeling for Process Operation</td></tr>
<tr><td>3</td><td>Transformation Techniques</td></tr>
<tr><td>4</td><td>Linearization of Model Equations</td></tr>
<tr><td>5</td><td>Operating Points and Process Simulation</td></tr>
<tr><td>6</td><td>Frequency Response Analysis and General Process Behavior</td></tr>
<tr><td>7</td><td>Midterm Exam I</td></tr>
<tr><td>8</td><td>Process Control and Instrumentation</td></tr>
<tr><td>9</td><td>Behaviour of Controlled Processes and Simulink</td></tr>
<tr><td>10</td><td>Characteristic Polynomial and Feedback Control System</td></tr>
<tr><td>11</td><td>Control System Toolbox and Transfer Function Models</td></tr>
<tr><td>12</td><td>Analysis of a Mixing Process and Dynamics of Chemical Stirred Tank Reactors</td></tr>
<tr><td>13</td><td>Midterm Exam II</td></tr>
<tr><td>14</td><td>Dynamic Analysis of Tubular Reactors, Dynamic Analysis of Heat Exchangers</td></tr>
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<tr><td>Educative Activities
(Credit will be determined based on the time given for these activities. Should be filled carefully.)</td><td>Theoretical Study Hours of Course Per Week
Reading
Searching in Internet and Library
Preparing Reports
Mid-Term and Studying for Mid-Term
Final and Studying for Final</td></tr>
<tr><td>Assessment Criteria</td><td>
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<tr><th></th><th>Quantity</th><th>Total Contribution (%)</th></tr>
<tr><td>Midterm</td><td>2</td><td>40</td></tr>
<tr><td>Homework</td><td>1</td><td>20</td></tr>
<tr><td>Assignment</td><td></td><td></td></tr>
<tr><td>Projects</td><td></td><td></td></tr>
<tr><td>Practice</td><td></td><td></td></tr>
<tr><td>Quiz</td><td></td><td></td></tr>
<tr><td>Contribution of In-term Studies to Overall Grade</td><td></td><td>60</td></tr>
<tr><td>Contribution of Final Examination to Overall Grade</td><td></td><td>40</td></tr>
<tr><td>Attendance</td><td></td><td></td></tr>
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Workload of the Course

Activity	Total Week Count	Weekly Duration (in hour)	Total Workload in Semester
Theoretical Study Hours of Course Per Week	14	3	42
Practicing Hours of Course Per Week			
Reading	5	2	10
Searching in Internet and Library	5	2	10
Designing and Applying Materials			
Preparing Reports	2	5	10
Preparing Presentation			
Presentation			
Mid-Term and Studying for Mid-Term	2	5	10
Final and Studying for Final	1	6	6
Other			
Total work load			88
Total work load/25			3,52
ECTS of the course			4

Course's Contribution To Program

No	Program Learning Outcomes	1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.			x		
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.			x		
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.			x		
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.			x		
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.		x			
6	Ability to work efficiently in intra-disciplinary teams.		x			
7	Ability to work efficiently in multi-disciplinary teams;		x			
8	Ability to work individually.		x			
9	Ability to communicate effectively in Turkish/English, both orally and in			x		

		writing; Ability to write effective reports and comprehend written reports, make effective presentations,					
	10	prepare design and production reports, give and receive clear and intelligible instructions.		x			
	11	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.		x			
	12	Awareness of professional and ethical responsibility.			x		
	13	Information about business life practices such as project management, risk management, and change management.		x			
	14	Information about awareness of entrepreneurship, innovation, and sustainable development.		x			
	15	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety.		x			
	16	Knowledge about awareness of the legal consequences of engineering solutions.	X				
	17	Knowledge on standards used in engineering practice.		x			
Name of Lecturer(s) and Contact Iınformation	1. Dr. Alpay ŞAHİN asahin@gazi.edu.tr						