## 1. Course Description

| COURSE DESCRIPTION FORM | |
|---|---|
| **Course Code and Title** | CHE451 CHEMICAL ENGINEERING DESIGN I |
| **Course Semester** | 7 |
| **Catalog Description (Content) of the Course** | Design of equipment used in chemical industry and determination of optimum operating conditions. Various pipeline, storage tank, heat exchanger, separation process and reactor design project. Cost analysis. Computer-aided design applications. |
| **Main Textbook** | Peters M.S, Timmerhaus K.D., West, R.E. "Plant Design andEconomicsForChemicalEngineers", Fifth ed., McGraw-Hill, New York (2003). |
| **Supporting Textbooks** | • Turton, R., Bailie, R.C., Whiting, W.B., Shaeiwitz, J.A., Bhattacharyya D., "Analysis Synthesis and Design of Chemical Processes", 4th Edt., Prentice Hall, New Jersey, 2013.<br>• Seider.W.D.,Seader, J.D.,Lewin, D,R., Widago, S., "Product andProcess Design Principles", 3rd ed., Wiley, New York, 2010.<br>• J.M. Coulson, J.F. Richardson and R.K. Sinnott, Chemical Engineering Volume & Design, 4th ed., Butterworth-Heinemann, Oxford, 2005.<br>• D.F. Rudd and C.C. Watson, Strategy of Process Engineering, John Wiley and Sons. Inc., New York, 1968<br>• Douglas, J. M., "Conceptual Design for Chemical Processes", McGraw-Hill, New York, 1988.<br>• J.R. Backhurst and J.H. Harker, Process Plant Design, Heinemann Educational Books Ltd., London, 1983.<br>• Perry, R.H.,Green,D.W., "Perry'sChemicalEngineers' Handbook," Seventh ed., McGraw-Hill, New York, 1998.<br>• Biegler, L.T., Grosmann, I.E., Westerbeg, A.W., "Systematic Methods of Chemical Process Design", Prentice Hall, NewJersey (1997).<br>• Smith, R., "Chemical Process Design and Integration", Wiley (2005).<br>• Sinnott, Rk.K., "An Introduction to Chemical Engineering Design", Pergamon Press, Oxford (1983).<br>• Backhurst, C.R., Marker J.H., "Process Plant Design", Heinmann, London (1973).<br>• Douglas, J.M., "Conceptual Design of Chemical Processes", McGraw-Hill, New York (1988).<br>• Ulrich, G.D., "A Guide to Chemical Engineering Process Design and Economics", John Wiley, New York (1984).<br>• Resnick, W., "Process Analysis and Design for Chemical Engineers", McGraw-Hill, NewYork (1981).<br>• Rudd, D.F., Powers, G.J., Siirola, J.J., "Process Synthesis", PrenticeHall, NewJersey (1973).<br>• Mecklenburgh, J.C., "Plant Layout", Leonard Hill Books, Guildford (1973).<br>• Vilbrandt, F.C., Dryden, C.E., "Chemical Engineering Plant Design", 4th Ed., McGraw-Hill, NewYork (1959).<br>• Wells, G.L., Rose, L.M., "The Art of the Chemical Process Design", Elsevier Science Pub., Amsterdam (1986).<br>• Edgar, T.F., Himmelblau, D.M., "Optimization of Chemical Processes", McGraw-Hill, (2001).<br>• Speight, J., " Chemical Process and Design Handbook", 1st Ed., McGraw-Hill, (2002). |
| **Course Credit (ECTS)** | 7 |
| **Prerequisites of the Course (Compulsory attendance should be indicated here.)** | KM 321 Heat Transfer, KM 302 Mass Transfer, KM 341 Chemical Reaction Engineering, KM 378 Engineering Economics |
| **Type of the Course** | Compulsory |
| **Instruction Language of the Course** | English |

<table>
<tr><td>Object and Target of the Course</td><td>Understanding the general philosophy to be followed in the design of basic equipments of chemical processes, learning optimization techniques, making cost calculations for basic equipments, to make detailed design and to find optimum parameters of at least a pipe line, a heat exchanger, a distillation column and a reactor. To provide experience in team work.</td></tr>
<tr><td>Learning Outcomes of the Course</td><td>General philosophy and approach to be followed in the design of basic equipment of chemical processes.<br>Making the synthesis of the learned professional concepts and applying to design studies.<br>Formulation of design problems, determination of solution method sand application.<br>Assessment of alternative options.<br>Detailed design of main equipment, determination of optimum design parameters and making cost calculations.<br>Raising awareness of environmental, safety and similar concepts in design.<br>Engineering ethics concept and awareness.<br>Creativity improvement. Development of professional self-confidence.<br>Team work skills.<br>Improvement of written and oral communication skills.</td></tr>
<tr><td>Mode of Delivery</td><td>Project studies</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>Design philosophy and strategy.</td></tr>
<tr><td>2</td><td>System structure; Information flow structure; Design variable selection algorithm.</td></tr>
<tr><td>3</td><td>Cost calculations and economic design criteria.</td></tr>
<tr><td>4</td><td>Pipeline design</td></tr>
<tr><td>5</td><td>Pipeline design</td></tr>
<tr><td>6</td><td>Heat exchanger design</td></tr>
<tr><td>7</td><td>Heat exchanger design</td></tr>
<tr><td>8</td><td>Reactor design,</td></tr>
<tr><td>9</td><td>Reactor design</td></tr>
<tr><td>10</td><td>Reactor design</td></tr>
<tr><td>11</td><td>Separation unit design</td></tr>
<tr><td>12</td><td>Separation unit design</td></tr>
<tr><td>13</td><td>Separation unit design</td></tr>
<tr><td>14</td><td>Separation unit design</td></tr>
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<tr><td>Educative Activities<br>(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<br>Practising Hours of Course Per Week<br>Reading<br>Searching in Internet and Library<br>Designing and Applying Materials<br>Preparing Reports<br>Preparing Presentation<br>Presentation<br>Mid-Term and Studying for Mid-Term<br>Final and Studying for Final</td></tr>
<tr><td>Assessment Criteria</td><td>
<table>
<tr><th></th><th>Quantity</th><th>Total Contribution (%)</th></tr>
<tr><td>Midterm</td><td>3</td><td>30</td></tr>
<tr><td>Homework</td><td>0</td><td>0</td></tr>
<tr><td>Assignment</td><td>0</td><td>0</td></tr>
<tr><td>Projects</td><td>4</td><td>40</td></tr>
<tr><td>Practice</td><td>0</td><td>0</td></tr>
<tr><td>Quiz</td><td>0</td><td>0</td></tr>
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| Contribution of In-term Studies to Overall Grade | | 70 | |
| Contribution of Final Examination to Overall Grade | | 30 | |
| Attendance | | | |

**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 | 14 | 2 | 28 |
| Reading | 14 | 1 | 14 |
| Searching in Internet and Library | 14 | 1 | 14 |
| Designing and Applying Materials | 14 | 1 | 14 |
| Preparing Reports | 4 | 3 | 12 |
| Preparing Presentation | 4 | 3 | 12 |
| Presentation | 4 | 3 | 12 |
| Mid-Term and Studying for Mid-Term | 3 | 3 | 9 |
| Final and Studying for Final | 1 | 6 | 6 |
| Other | 0 | 0 | 0 |
| Total work load | | | 163 |
| Total work load/25 | | | 6,52 |
| ECTS of the course | | | 7 |

**Course's Contribution To Program**

| No | Program Learning Outcomes | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 1 | Adequateknowledge in mathematics, scienceandengineeringsubjectspertainingtotherelevant discipline; abilitytousetheoreticalandappliedinformation in theseareasto model andsolveengineeringproblems. | | | | x | |
| 2 | Abilitytoidentify, formulate, andsolvecomplexengineeringproblems; abilitytoselectandapplyproperanalysisandmodelingmethodsforthispurpose. | | | x | | |
| 3 | Abilitytodesign a complexsystem, process, deviceorproductunderrealisticconstraintsandconditions , in such a way as tomeetthedesiredresult; abilitytoapply modern designmethodsforthispurpose. | | | | | x |
| 4 | Abilitytodevise, select, anduse modern techniquesandtoolsneededforengineeringpractice; abilitytoemployinformationtechnologieseffectively. | | | | | x |
| 5 | Abilitytodesignandconductexperiments, gatherdata, analyzeandinterpretresultsforinvestigatingengineeringproblems. | x | | | | |
| 6 | Abilitytoworkefficiently in intra-disciplinaryteams. | | | x | | |
| 7 | Abilitytoworkefficiently in multi-disciplinaryteams; | x | | | | |
| 8 | Abilitytoworkindividually. | | | x | | |
| 9 | Abilitytocommunicateeffectively in Turkish/English, bothorallyand in writing; | | | | | x |

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|---|---|---|---|---|---|---|---|
| | | Abilitytowriteeffectivereportsandcomprehendwrittenreports, makeeffectivepresentations, | | | | | |
| | 10 | preparedesignandproductionreports, giveandreceiveclearandintelligibleinstructions. | | | | | x |
| | 11 | Recognition of theneedforlifelonglearning; abilitytoaccessinformation, tofollowdevelopments in scienceandtechnology, andtocontinuetoeducatehim/herself. | | | x | | |
| | 12 | Awareness of professionalandethicalresponsibility. | | | | x | |
| | 13 | Information aboutbusiness life practicessuch as projectmanagement, risk management, andchangemanagement. | | | | | x |
| | 14 | Information aboutawareness of entrepreneurship, innovation, andsustainabledevelopment. | | | x | | |
| | 15 | Knowledge aboutcontemporaryissuesandtheglobalandsocietaleffects of engineeringpractices on health, environment, andsafety. | | | x | | |
| | 16 | Knowledge aboutawareness of the legal consequences of engineeringsolutions. | | | | x | |
| | 17 | Knowledge on standardsused in engineeringpractice. | | | x | | |
| **Name of Lecturer(s) and Contact Iınformation** | | 1. Prof.Dr. İrfan AR irfanar@gazi.edu.tr<br>2. Prof.Dr. Suna BALCI sbalci@gazi.edu.tr<br>3. Prof.Dr. N. Alper TAPAN atapan@gazi.edu.tr<br>4. Prof.Dr. Sena YAŞYERLİ syasyerli@gazi.edu.tr | | | | | |