

## 1. Course Description

| COURSE DESCRIPTION FORM                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
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| Course Code and Title                                                                                                         | CHE473 PROCESS CONTROL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Course Semester                                                                                                               | 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Catalog Description (Content) of the Course                                                                                   | Basic process elements, Components and Controllers; Study of open and closed circuit systems; Frequency response method; Process applications                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Main Textbook                                                                                                                 | D.R. Coughanowr, "Process Systems Analysis and Control", 2nd edition, Mc-GrawHill, New York, 3 <sup>rd</sup> Edition, 2008.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Supporting Textbooks                                                                                                          | 1. Seborg D.E., Edgar T.F., Mellichamp D.A., "Process Dynamics and Control", Wiley, NY, 3rd Edition, 2011.<br>2. Seborg D.E., Edgar T.F., Mellichamp D.A., Doyle F.J., "Proses Dinamiği ve Kontrolü", Çevirenler, Prof. Dr. Niyazi Alper Tapan, Prof. Dr. Sebahat Erdoğan, Nobel yayınevi, 2013.<br>3. G. Stephanopoulos, "Chemical Process Control: An Introduction to theory and Practice", Prentice-Hall, 1984.                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Course Credit (ECTS)                                                                                                          | 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Prerequisites of the Course<br>(Compulsory attendance should be indicated here.)                                              | There is no prerequisite for this course.<br>There is 70% attendance requirement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Type of the Course                                                                                                            | Theoretical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Instruction Language of the Course                                                                                            | English                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Object and Target of the Course                                                                                               | To teach fundamental concepts of process dynamics and control; To give an introduction to design and analysis of process systems                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Learning Outcomes of the Course                                                                                               | 1. To teach fundamental concepts of process dynamics and control;<br>2. To analyze the control systems<br>3. To give an introduction to design and analysis of control systems<br>4. To analyze the stability of controlled process                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Mode of Delivery                                                                                                              | Face to face education                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Weekly Schedule of the Course                                                                                                 | <b>1. Week:</b> Introduction Laplace Transformation<br><b>2. Week:</b> Linearization and Transfer Functions<br><b>3. Week:</b> Response of First Order Systems<br><b>4. Week:</b> Response of First Order Systems in Series<br><b>5. Week:</b> Response of Second Order Systems and Transportation lag<br><b>6. Week:</b> Response of Second Order Systems and Transportation lag<br><b>7. Week:</b> Closed Loop Control Systems<br><b>8. Week:</b> Transient Response of Simple Control Systems<br><b>9. Week:</b> Closed Loop Transfer Functions<br><b>10. Week:</b> Closed Loop Transfer Functions<br><b>11. Week:</b> Stability analysis<br><b>12. Week:</b> Frequency Response Methods, Bode Diagrams<br><b>13. Week:</b> Frequency Response Methods, Bode Diagrams<br><b>14. Week:</b> Control System Design and applications. |
| Educative Activities<br>(Credit will be determined based on the time given for these activities. Should be filled carefully.) | Theoretical Study Hours of Course Per Week<br>Reading<br>Searching in Internet and Library<br>Designing and Applying Materials<br>Preparing Reports<br>Mid-Term and Studying for Mid-Term<br>Final and Studying for Final                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

|                                         |                                                    |                                                                                                                                                                                                                       |                                  |                                   |   |   |   |   |   |
|-----------------------------------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------------|---|---|---|---|---|
| <b>Assessment Criteria</b>              |                                                    | <b>Quantity</b>                                                                                                                                                                                                       | <b>Total Contribution (%)</b>    |                                   |   |   |   |   |   |
|                                         | Midterm                                            | 2                                                                                                                                                                                                                     | 40                               |                                   |   |   |   |   |   |
|                                         | Homework (min.)                                    | 2                                                                                                                                                                                                                     | 5                                |                                   |   |   |   |   |   |
|                                         | Assignment                                         | 0                                                                                                                                                                                                                     | 0                                |                                   |   |   |   |   |   |
|                                         | Projects                                           | 1                                                                                                                                                                                                                     | 10                               |                                   |   |   |   |   |   |
|                                         | Practice                                           | 0                                                                                                                                                                                                                     | 0                                |                                   |   |   |   |   |   |
|                                         | Quiz (min.)                                        | 2                                                                                                                                                                                                                     | 5                                |                                   |   |   |   |   |   |
|                                         | Contribution of In-term Studies to Overall Grade   |                                                                                                                                                                                                                       | 60                               |                                   |   |   |   |   |   |
|                                         | Contribution of Final Examination to Overall Grade |                                                                                                                                                                                                                       | 40                               |                                   |   |   |   |   |   |
|                                         | Attendance                                         | %70                                                                                                                                                                                                                   |                                  |                                   |   |   |   |   |   |
| <b>Workload of the Course</b>           | <b>Activity</b>                                    | <b>Total Week Count</b>                                                                                                                                                                                               | <b>Weekly Duration (in hour)</b> | <b>Total Workload in Semester</b> |   |   |   |   |   |
|                                         | Theoretical Study Hours of Course Per Week         | 14                                                                                                                                                                                                                    | 3                                | 42                                |   |   |   |   |   |
|                                         | Practicing Hours of Course Per Week                | 0                                                                                                                                                                                                                     | 0                                | 0                                 |   |   |   |   |   |
|                                         | Reading                                            | 14                                                                                                                                                                                                                    | 3                                | 42                                |   |   |   |   |   |
|                                         | Searching in Internet and Library                  | 5                                                                                                                                                                                                                     | 5                                | 25                                |   |   |   |   |   |
|                                         | Designing and Applying Materials                   | 2                                                                                                                                                                                                                     | 2                                | 4                                 |   |   |   |   |   |
|                                         | Preparing Reports                                  | 4                                                                                                                                                                                                                     | 3                                | 12                                |   |   |   |   |   |
|                                         | Preparing Presentation                             | 0                                                                                                                                                                                                                     | 0                                | 0                                 |   |   |   |   |   |
|                                         | Presentation                                       | 0                                                                                                                                                                                                                     | 0                                | 0                                 |   |   |   |   |   |
|                                         | Mid-Term and Studying for Mid-Term                 | 2                                                                                                                                                                                                                     | 3                                | 6                                 |   |   |   |   |   |
|                                         | Final and Studying for Final                       | 1                                                                                                                                                                                                                     | 10                               | 10                                |   |   |   |   |   |
|                                         | Other                                              | 0                                                                                                                                                                                                                     | 0                                | 0                                 |   |   |   |   |   |
|                                         | Total work load                                    |                                                                                                                                                                                                                       |                                  | 141                               |   |   |   |   |   |
|                                         | Total work load/25                                 |                                                                                                                                                                                                                       |                                  | 5.64                              |   |   |   |   |   |
|                                         | ECTS of the course                                 |                                                                                                                                                                                                                       |                                  | 6                                 |   |   |   |   |   |
| <b>Course's Contribution To Program</b> | 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 |   |   |   |

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|--|----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|---|---|--|--|--|
|  | 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 writing; Ability to write effective reports and comprehend written reports, make effective presentations, |                                                                                                                      |   | X |  |  |  |
|  | 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                                                                                                                    |   |   |  |  |  |
|  | <b>Name of Lecturer(s) and Contact Information</b> |                                                                                                                                                                                     | 1. Prof. Dr. SebahatERDOĞAN, E-mail: sebaer@gazi.edu.tr<br>2. Prof. Dr. NiyaziAlperTAPAN, E-mail: atapan@gazi.edu.tr |   |   |  |  |  |