Process Control Systems

A Jointly Sponsored Undergraduate Program

Process Control Systems is a program intended to provide students with a broad background in chemical and systems engineering, with emphasis on the science and technology of process automation. Through a careful selection of courses in chemical engineering and systems engineering, a unified approach is developed to the analysis, design, operation and control of chemical and other manufacturing processes. Electives in systems engineering allow further in-depth specialization in applied mathematics, discrete-event systems, robotics, quality control, optimization and dynamical systems.

In addition to the traditional laboratory work in chemistry, physics and chemical engineering, a laboratory course in digital process control is offered based on computers and advanced commercial distributed-control equipment. Familiarity with computers and with process modeling, data acquisition and control software is an essential component of the training. In the senior year, students can elect to complete a major design project either in chemical processing systems (chemical engineering) or in technological or engineering systems (systems engineering).

Upon successful completion, a student receives both the Bachelor of Science in Chemical Engineering and the Bachelor of Science in Systems Science and Engineering.

The Process Control Systems program satisfies an increasing demand by manufacturing and petrochemical companies for professionals trained in advanced automation to improve product quality, to reduce costs, to improve capital productivity, and to improve safety and environmental quality. This interdisciplinary program provides the background necessary to combine traditional engineering skills with new systems engineering techniques and meet these challenges. The program is staffed by faculty members from both departments and is supervised by a coordinating committee. Students are assigned two advisers, one from each department, who are members of the committee.

Further information about the program can be obtained from the coordinating committee through either of the cooperating departments.

The Process Control Systems Program

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>First Year</td>
<td></td>
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<tr>
<td>Calculus II, III (Math 132, 233)</td>
<td>3</td>
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<td>General Physics I, II (Physics 117A, 118A)</td>
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<td>General Chemistry I, II (Chem 111A, 112A)</td>
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<td>General Chemistry Laboratory I, II (Chem 151, 152)</td>
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<tr>
<td>Matrix Algebra (Math 309)</td>
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<tr>
<td>Introduction to Systems Science and Engineering (ESE 151)</td>
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<tr>
<td>Humanities or social sciences elective</td>
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<td><strong>Total</strong></td>
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<tr>
<td>Second Year</td>
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<tr>
<td>Organic Chemistry I with Lab (Chem 261)</td>
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<td>Differential Equations (Math 217)</td>
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<tr>
<td>Thermodynamics (ChE 320)</td>
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<td>Engineering Analysis of Chemical Systems (ChE 351)</td>
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<tr>
<td>Computer Science I (CSE 131)</td>
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<tr>
<td>Principles of Biology I (Biol 2960)</td>
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<tr>
<td>Modeling and Computing in Chemical Engineering (ChE 275)</td>
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<tr>
<td>Probability and Statistics for Engineering (ESE 326)</td>
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<tr>
<td>Engineering Mathematics A (ESE 318)</td>
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<tr>
<td>Engineering Mathematics B (ESE 319)</td>
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<tr>
<td>Third Year</td>
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<tr>
<td>Signals and Systems (ESE 351)</td>
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<td>Operations Research (ESE 403)</td>
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<td>Transport Phenomena I, II (ChE 367, 368)</td>
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<td>Materials Science (ChE 325)</td>
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<td>Systems science and engineering elective</td>
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<td>Engineering Ethics and Sustainability (Engr 4501)</td>
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<td>Engineering Leadership and Team Building (Engr 4502)</td>
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<td>Conflict Management and Problem Solving in Engineering (Engr 4503)</td>
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<td>Mass Transfer Operations (ChE 357)</td>
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<tr>
<td>Molecular Transport Processes and Chemical Kinetics (ChE 359)</td>
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<td>Humanities or social sciences elective</td>
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<tr>
<td>Technical Writing (Engr 310)</td>
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<tr>
<td>Fourth Year</td>
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<tr>
<td>Chemical Reaction Engineering (ChE 471)</td>
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<tr>
<td>Chemical Engineering Laboratory (ChE 473A)</td>
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Computer science elective from approved list (excluding CSE 200) 3 —
Systems science and engineering elective 3 3
Humanities or social sciences elective 3 3
Control Systems or Chemical Process Dynamics and Control (ESE 441 or ChE 462) 3 —
Capstone Project or Process and Product Design (ESE 499 or ChE 478A) — 3
Digital Process Control Laboratory (ESE 449 or ChE 433) — 3
Chemical Engineering elective — 3
Energy Transfer Processes (ChE 369) — 3

Total units 19 18

Coordinating Committee

Pratim Biswas
Lucy and Stanley Lopata Professor
PhD, California Institute of Technology
(Energy, Environmental and Chemical Engineering)

Hiroaki Mukai
PhD, University of California–Berkeley
(Electrical and Systems Engineering)

Heinz Schaettler
PhD, Rutgers University
(Electrical and Systems Engineering)

Jay R. Turner
DSc, Washington University
(Chemical Engineering)

To satisfy the core requirements of the School of Engineering & Applied Science, the following courses are required:

Physics 117A & Physics 118A and General Physics II 8
Chem 111A & Chem 112A and General Chemistry II 6
Chem 151 & Chem 152 and General Chemistry Laboratory I 4
& Math 233 and Calculus III 4
Math 217 and Differential Equations 9
Humanities/social sciences electives 18

Total units 45

To complete the core requirements of both chemical engineering and systems engineering, the following additional requirements apply:

Chem 261 Organic Chemistry I with Lab 4
ChE 325 Materials Science 3
ESE 326 Probability and Statistics for Engineering 3

Engr 310 Technical Writing 3
ESE 318 Engineering Mathematics A 6
& ESE 319 and Engineering Mathematics B 3
CSE 200 Engineering and Scientific Computing 3
Biol 2960 Principles of Biology I 4

Total units 26

The balance of the curriculum is carefully structured to satisfy the combined degree requirements and to meet the objectives of the program. See the accompanying Process Control Systems program chart for the details. The general degree requirements include the residency and other applicable requirements of the university and the School of Engineering & Applied Science.

The curriculum meets the requirements of both degrees and can be completed in four years. The total number of units required is 141. The semester course load exceeds the usual schoolwide average of 15 units per semester, so students must be highly motivated to accomplish this objective in eight semesters. The course load in individual semesters may be lightened by attending summer school or by adding an additional semester. A number of courses (e.g., Engr 310, Math 309, ESE 318, ESE 319, ESE 326, ESE 351; and humanities and social sciences courses) usually are offered in the summer as well.

There is no minor in this area.

There are no courses specific to this program.