CENG2110 Process and Product Design Principles **Fall 2023-24**

Instructors:
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TAs: tbc

Scope: Processes and process variables, engineering data, and process representations. The conservation principle. Material and energy balances on non-reactive and reactive unit operations and process systems with recycles. Computational tools for solving sets of equations. Introduction to chemical product design.

Learning objectives: On successful completion of this course, students are expected to be able to:

1. Explain the essential building blocks of processes, taking into account the categories and attributes of the materials involved, including raw materials, intermediates, products and by-products.
2. Use a variety of methods for organizing information relating to materials for the purpose of product and process design, analysis, and optimization.
3. Identify and analyze mass and energy balances for different kinds of chemical processing units with and without chemical reactions and for complete process systems with recycles.
4. Use computational tools to solve sets of equations that often arise in the various stages of chemical process and product design.
5. Explain the scope of chemical product design.
6. Recognize considerations related to safety, health, and environment for chemical process & product development.

Content

- Chemical process and product definition and classifications
- Design and analysis of input-output diagrams
- Process variables and diagrams.
- Material and energy balances: concept and mathematical analysis applied to (1) processing systems with reactions, separations, recycles and purge streams and (2) chemical products.
- Systematic design procedures for chemical products and processes.
- Comprehensive case studies related to energy, chemicals, the environment, and pharmaceuticals.

Assessment

- 4 Homework (calculation) 10%
- In class performance and 5 quizzes (the least excluded) 15%
- Group project: open-ended design case study 15%
- Final Exam (open book, computer and internet) 60%

Late submissions of any work will incur 10% deduction for the 1st week after the deadline and 0 mark thereafter.

Study group is encouraged; however, every student needs to write up his/her own final answers individually. Plagiarism and academic dishonesty will not be tolerated in any shape or form. No distinction will be made between those who copied work from classmates (or other sources) and those who offered their work to others.

Course Delivery

The course will be offered through a combination of lectures and tutorials. Tutorial sessions typically provide an opportunity to work on an example problem with real-time support of the instructors. Those tutorial sessions are also a good opportunity to ask questions about the lectures. This course is about developing skills and not about passively absorbing information, therefore, attendance and active participation during these tutorial sessions is strongly recommended. Recordings of the lectures and problem sets from the tutorial sessions will be made available to course participants through Canvas.

Textbooks

- M. Murphy. (2007) Introduction to Chemical Processes, International Edition. McGraw-Hill, New York, NY, USA. E-Book
- D.M. Himmelblau, J.B. Riggs. (2012) Basic principles and calculations in chemical engineering. Prentice Hall, Upper Saddle River, N.J. E-Book
- D. Seider, D. R. Lewin, J. D. Seader, S. W., R. Gani, K. M. Ng (2016). Product and Process Design Principles: Synthesis, Analysis and Evaluation (eBook), 4th edition, E-Book