**CHEN 3600 - COMPUTER-AIDED CHEMICAL ENGINEERING (3)**

**Required Core Course**

**2015-2016 Catalog Data Lec (2), Lab (3).** General and structured programming concepts, numerical methods, and introductory probability and statistics concepts. Application to chemical engineering problems involving material and energy balances and transport process, data validation, and analysis.

**Prerequisites** Pr: COMP 1200, MATH 2650 and completion of CHEN 2610 with a grade of C or higher

**Schedule** Two one-hour class sessions and two 75-minute lab sessions per week.

**Course Objectives** Systematic approach to solving chemical engineering problems using analytical and synthetic approaches. Effective communication of problem solution and recommendations using established formats for writing elements. General and structured programming concepts, introductory probability and statistics concepts. Application to chemical engineering problems involving material and energy balances and transport process, data validation and analysis.

**Textbooks**

Hahn, Essential MATLAB for Engineers and Scientists, 5e, 2013, 9780123943989, Academic Press

**Lecture Topics Covered**

1. Introduction, departmental format for graphs, tables, equations (1 week)
2. Introduction to problem solving (1 week)
3. Graphing with Excel (1 week)
4. Excel functions, programming concepts (structured programming) (1 week)
5. Matrix operations, linear regression, problem solving (Bloom’s Taxonomy) (1 week)
6. Iterative solutions, using macros in Excel (1 week)
7. Optimization (Solver), programming concepts (stepwise improvement method) (1 week)
8. Technical writing, critical analysis, proofreading, professional expectations (2 weeks)
9. Programming with VBA (2 weeks)
10. Probability and statistics (1 week)
11. Sampling from distributions (simulation) (2 weeks)
12. Hypothesis testing (1 week)

Exams (3 exams given during week 6, 11, 14)

**Lab Topics Covered**

1. Example problems and laboratory projects draw from the chemical engineering field whereby the student learns to apply appropriate software or numerical methods. Problems will be taken from the areas of material and energy balances, thermodynamics, transport, kinetics, data fitting and analysis of experimental data and steady state and dynamic modeling. Review of technical writing elements and critical review of student writing(15 weeks)

**Course Outcomes:** Upon successful completion of this course, students should be able to:

1. Employ critical thinking skills and systematic problem solving methods to develop appropriate mathematical models that can be used to solve various engineering problems.
2. Explain and employ probability concepts (including expectation, probability, likelihood, descriptive statistics, discrete and continuous random variables, probability distribution functions, cumulative distribution functions, inverse distribution functions).
3. Apply discrete distribution functions (e.g., Bernoulli, binomial) and continuous distribution functions (e.g., standard normal, normal) to solve problems involving random behavior.
4. Sample data (via simulation) from discrete and continuous distributions.
5. Explain the concept of hypothesis testing and set-up and interpret the results of hypothesis tests involving the mean and proportion.
6. Employ programming concepts (e.g., programming structures) to solve engineering problems.
7. Create, modify and employ user defined functions and scripts as appropriate for solving engineering problems.
8. Explain and apply mathematical concepts and constructs (e.g., mathematical functions, rates of change, areas under curves, Laplace transform, Monte Carlo Simulation) encountered in engineering problems.
9. Employ one-dimensional arrays and two-dimensional matrices to represent, store and manipulate data collections.
10. Solve single and systems of algebraic equations.
11. Solve single and multi-variable linear regression problems.
12. Employ the “stepwise improvement method” to develop solutions for programming problems.
13. Prepare written communications (e.g., technical reports and memos) that effectively convey technical information to the intended audience.
14. Create effective graphs (e.g., x-y, scatter, line, surface, etc.). Select appropriate trend lines. Graph parametric functions.

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| **Contribution of Course to Meeting ABET Criteria 5 (Curriculum)** | | |
| **Math and Basic Sciences** | **Engineering Topics** | **General Education** |
| 0 Credits | 3 Credits | 0 Credits |

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| **Relationship of Course to Student Outcomes (PO’s)** | | | | | | | | | | | | |
| **Student Outcome** | **A** | **B** | **C** | **D** | **E** | **F** | **G1** | **G2** | **H** | **I** | **J** | **K** |
| **Level of Coverage** | S | S | I | R | S | I | S |  | I | S | R | S |

**Date of Preparation and Person(s) Preparing This Description**September 18, 2015: Elizabeth Lipke, W. Robert Ashurst, Allan E. David