The
University
of Jordan
School of Engineering
Electrical Engineering Department
1st Semester – A.Y. 2018/2019

Course: **Numerical Methods in Chemical Engineering – CHE 0935301 (3 Cr. – RequiredCourse)**

Instructor: Prof. Reyad Shawabkeh

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Office Hours: Sun Tue Thu 10:00-11:00, 1:00-2:00 Mon Wed 11:00 - 1:00

Course website: http://elearning.ju.edu.jo

Catalog description: This course introduces students to the formulation, methodology, and techniques for numerical solution of chemical engineering interest. These methods can be used to solve problems in Fluid Flow, Heat and mass Transfer, Reaction Engineering and Thermodynamics. Topics covered include: computers and error analysis, root finding, solution of linear and nonlinear system of equations, interpolation and curve fitting, numerical integration and differentiation, and solution of ordinary differential equations. Also, Partial differential equations and their numerical solution are briefly discussed in this course.

Prerequisites by course: **ChE** **096520** Computer Applications in Chemical Engineering (pre-requisite) **0935441**

Prerequisites by topic: Students are assumed to have sufficient knowledge pertaining to the following:
1. Computer application in chemical Engineering
2. Basic mathematical methods related to chemical engineering

Textbook: **Chapra, S.C. and Canale, R.P., 2009, " Numerical Methods for Engineers", 6th Ed., McGraw-Hill.**

References:

1. Hoffman, J.D., "Numerical Methods for Engineers and Scientists", McGraw-Hill (1992).
2. Gerald, C.F., and Wheatly, P.O., "Applied Numerical Analysis". 6th Eddition, Addison Wesley, 1999.
3. Fausett, L.V., "Applied Numerical Analysis Using Matlab", Prentice-Hall (1999).
4. Conte, S.D. and De Boor, C., "Elementary Numerical Analysis. An Algorithmic Approach", 3rdEd., McGraw-Hill (1981).
5. Davis, M.E., "Numerical Methods and Modeling for Chemical Engineers", Wiley (1984).
6. Mathews, J.H., "Numerical Methods for Computer Science, Engineering and Mathematics",

Prentice-Hall (1987).

7. Penny, J. and Lindfield, G., “Numerical Methods Using Matlab”, Ellis Horwood (1995).
8. Riggs, J.B., “An Introduction to Numerical Methods for Chemical Engineers”, Texas TechUniversity Press (1994).

Schedule: 32 lectures (50 minuets) plus 11 labs (3 hrs)

Course goals:

1. Students will demonstrate the ability to apply numerical techniques to approximate solutions of linear and nonlinear equations.
2. Students will demonstrate the ability to apply numerical techniques to approximate areas under curves, as well as integrals and derivatives of functions of one variable.
3. Students will demonstrate the ability to apply numerical techniques to approximate and interpolate function values.
4. Students will demonstrate the ability to communicate advantages and disadvantages of various numerical techniques and evaluate appropriateness of specific numerical methods for solving linear and nonlinear system of mathematical problems.
5. Students will demonstrate the ability to apply numerical techniques to approximate solutions of ordinary differential equations and analyze the stability of these techniques.
6. Students will demonstrate the ability to translate these numerical problems into a computational algorithm using a high-level programming language such as EXCELL, MATLAP and POLYMATH

Course learning outcomes (CLO) and relation to ABET student outcomes (SO):

Upon successful completion of this course, a student should:

1. Understanding of the role of computation as a tool in real-world problem solving. **[1]**
2. Understanding of how computation is used to solve the most common mathematical problems frequently arising in engineering, science and technology **[1]**
3. Understanding of computational algorithms that are used to approximate numerical solutions of mathematical problems. **[1]**
4. Apply knowledge of numerical techniques in their further study of advanced topics in mathematics as well as science and engineering. **[1]**
5. 5. Learn how to translate a variety of problems in traditional and emerging chemical engineering fields into numerical problems and how to tune numerical algorithms for effective and efficient solution. **[1]**
6. 6. Practice how to present computer input and output in a comprehensible, editable, and interpretable way **[1]**

Course topics:

1. Introduction to MATLAB
2. Numerical Solution of Single and system of Nonlinear Equations

3. Numerical Solution of System of Algebraic Equations

4. Interpolation and Curve Fitting

5. Numerical Differentiation and Numerical Integration

6. Numerical Solution of Ordinary Differential Equations

7. Numerical Solution of Partial Differential Equations

8. Mid-Term Test

Ground rules: Attendance is required and strictly enforced. To that end, attendance will be taken every lecture; Absence of more than 5hours will result in the expulsion of the student from the course.

Assessment & grading policy:

Assignments		Quizzes	
First Exam		Projects (SO-G,H)	
Midterm	30%	Lab Work	
Final Exam	40%	Presentation	
		Total	1

Last Revised: December 5, 2018