



**The University of Jordan**  
**Faculty of Engineering & Technology**  
**Chemical Engineering Department**

CHE 0905231 *Mathematical Methods for Chemical Engineering*  
First Semester 2018/2019

**Course Catalog**

**3 Credit hours.** This course introduces students to the formulation, methodology, and techniques for mathematical solution of chemical engineering interest. These methods can be used to solve problems in Fluid Flow, Heat and mass Transfer, Reaction Engineering and Thermodynamics. This course involves various engineering mathematical concepts with the focus on chemical engineering applications. The material covered in the course includes first, second and higher order ordinary differential equations, system of first order ordinary differential equations in addition to series solutions, Laplace transforms and Fourier analysis. By the end of the course solution of simple partial differential equations will be covered as well.

**Instructor**

Instructor	<b>Prof. Naim M. Faqir</b> E-mail: <a href="mailto:faqir@ju.edu.jo">faqir@ju.edu.jo</a>	Office: CHE 3 <sup>rd</sup> Floor Web:	Tel: 22880
------------	--	---	------------

**Prerequisites**

Prerequisites by topic	Calculus III
Prerequisites by course	0301201

**Text book**

<b>Title</b>	Advanced Engineering Mathematics
<b>Author(s)</b>	Kreyszig, E.
<b>Publisher</b>	John Wiley & Sons
<b>Year</b>	2009
<b>Edition</b>	10 <sup>th</sup> Edition

**References**

<b>Books</b>	<ol style="list-style-type: none"><li>1. Brannan, J.R. and Boyce, W.E., "Differential Equations: An Introduction to Modern Methods and Applications", John Wiley, 2007.</li><li>2. Hunt, B.R., Lipsman, R.L., Osborn, J.E., and Rosenberg, J.M., "Differential Equations With Matlab", 2<sup>nd</sup> edition, John Wiley, 2005.</li><li>3. Greenberg, M.D., "Advanced Engineering Mathematics", 2<sup>nd</sup> edition, Prentice Hall, Upper Saddle River, 1998.</li><li>4. Farlow, S.G., "An Introduction to Differential Equations and Their Applications", McGraw-Hill, 1994.</li><li>5. Derrick, W.R. and Grossman, S.I., "Elementary Differential Equations with Applications", Wesley.</li><li>6. Boyce, W.E. and DiPrima, R.C., "Elementary Differential Equations and Boundary Value Problems", 5<sup>th</sup> edition, John Wiley, 1992.</li><li>7. R.K. Jain, S.R.K. Iyengar, "Advanced engineering mathematics", CRC Pr I Llc, 2002.</li><li>8. Thomas L. Harman, James Dabney, Norman Richert, "Advanced engineering mathematics using MAT-LAB V.4", 1997.</li><li>9. Dennis G. Zill, Michael R. Cullen, "Advanced engineering mathematics", 1992.</li><li>10. Glyn James, David Burley, and et al., "Advanced modern engineering mathematics", 1993.</li></ol>
--------------	--

11. C. Ray Wylie, Louis C. Barrett, "Advanced engineering mathematics", 6th-Edition, 1995.
12. Grant B. Gustafson, Calvin H. Wilcox, "Analytical and computational methods of advanced engineering mathematics", 1998.

### Objectives and Outcomes

Objectives	Outcomes
<ol style="list-style-type: none"> <li>1. Translating given chemical engineering problems into a mathematical model. [01]</li> <li>2. Solving the model by selecting and applying suitable mathematical methods. [01]  <i>First Order Differential Equations (Separable differential equations, Reduction to separable forms, Exact differential equations, Integrating factors, Linear differential equations, Reduction to linear form)</i>  <i>Second and Higher Order Differential Equations (Second Order D.E. reducible to the first order, Homogeneous Equations with constant coefficient and Euler-Cauchy Equation, Nonhomogeneous Equations with constant coefficients and Euler-Cauchy equations and their solution by Undetermined Coefficients and by Variation of Parameters)</i>  <i>System of Differential Equations (Homogeneous Linear Systems with Constant Coefficients, Nonhomogeneous Linear Systems and their solution by the Method of Undetermined Coefficients and the Method of Variation of Parameters)</i>  <i>Series Solution of Differential Equations (Power Series Method about an Ordinary Point, Frobenius Method about regular singular point)</i>  <i>Laplace Transform (Laplace Transforms, Transforms of Derivatives and Integrals, Differentiation and Integration of Transforms, Linear D.E. with Constant Coefficients, Laplace Transforms inversion by Partial Fractions, System of D.E.)</i> </li> <li>3. Understanding the meaning and the implications of the mathematical solution for the original problem. [01]</li> </ol>	<p>Students who successfully complete the course will be able to:</p> <ol style="list-style-type: none"> <li>1. Demonstrate knowledge and understanding of the concepts, principles, solution approaches and operational techniques for the various topics covered in the course. [01]</li> <li>2. Learn how to translate a variety of problems in traditional and emerging chemical engineering fields into mathematical problems and how to solve them analytically. [01]</li> </ol>

**Course Assessment:** The assessment of objectives will be achieved through homework assignments and examinations.

### Evaluation

Assessment Tool	Expected Due Date	Weight
First Exam	According to the department schedule	30 %
Second Exam	According to the department schedule	30 %
Final Exam	According to the University final examination schedule	40 %

<b>Topics Covered</b>		
<b>Week</b>	<b>Topics</b>	<b>Chepters in Text</b>
1	Concepts of Differential Equations	Handouts
2-4	First Order Differential Equations Applications to Chemical Engineering Problems	Chapter 1
5-7	Second Order Differential Equations Applications to Chemical Engineering Problems	Chapter 2
8-9	Third Order Differential Equations	Chapter 3
10-11	System of Differential Equations Applications to Chemical Engineering Problems	Chapter4
12-13	Series Solution of Differential Equations	Chapter 5
13-14	Laplace Transform	Chapter 6
15	Fourier Analysis	
15	Introduction Partial Differential Equations	