



**MUTAH UNIVERSITY**  
**Faculty of Engineering**  
**Department of Mechanical Engineering**



**Course Syllabus study plan 2021**

Course Code	Course Name	Credits	Contact Hours
0402307	Numerical Analysis	3	3

**INSTRUCTOR/COORDINATOR**

<b>Name</b>	Dr Ibrahim Alkhazali
<b>Email/Office</b>	ibrahimk@mutah.edu.jo
<b>Office Hours</b>	S,M,T 12:00 – 14:00
<b>Classroom/Time</b>	S.M.T 9:00-10:00

**TEXTBOO**

<b>Title</b>	Numerical Analysis, 9th Edition
<b>Author/Year/Edition</b>	Richard L. Burden & Douglas Faires, 2010
<b>Title</b>	Numerical Methods for Engineers, 7th Edition
<b>Author/Year/Edition</b>	Steven C. Chapra & Raymond P. Canale, 2015
<b>Other Supplemental Materials</b>	
<b>Title</b>	MatLab software application
<b>Author/Year/Edition</b>	Different Internet Tutorial Lessons

**SPECIFIC COURSE INFORMATION**

**A. Brief Description of the Content of the Course (Catalog Description)**

This course aims to teach students how to use computer programs to solve engineering problems by applying numerical methods. The course will introduce the importance of errors in calculations and will include several numerical techniques for the following topics: Roots finding, Solution of linear algebraic Equation, Interpolation, Integration and differentiation, Eigenvalues and Eigenvectors, Curve fitting, Solution of ordinary differential equations, Introduction to the solution of partial differential equation.

**B. Pre-requisites (P) or Co-requisites (C)**

Ordinary Differential Equations (0301203)

**C. Course Type (Required or Elective)**

Required

## SPECIFIC GOALS

### A. Course Learning Objectives (CLOs)

**By the end of this course, the student should be able to:**

- Understanding of common numerical techniques and use them to obtain approximate solutions for mathematical problems [1].
- Apply numerical methods to obtain approximate solutions to mathematical problems [1].
- Derive the numerical methods for various engineering problems, such as interpolation, differentiation, integration, solution of linear and nonlinear equations, and the solution of differential equations [1].
- Analyze and evaluate the accuracy and error of common numerical methods [1].
- Implement numerical methods in computer program such as Matlab [1].
- Write and efficient and well-documented computer program code and present numerical results in an informative way [1].

### B. Student Learning Outcomes (SOs) Addressed by the Course

1	2	3	4	5	6	7				
✓										

## BRIEF LIST OF TOPICS TO BE COVERED

List of Topics	No. of Weeks	Contact Hours
Introduction to Numerical Methods and errors.	1	3
Sources of Error, Propagation of Errors, Taylor Theorem Revisited , Roots of Algebraic Equations, Graphical Methods, Bisection Method	1	3
Newton Method, Secant Method, Systems of Nonlinear Equations.	1	3
Systems of Linear Equations, Gaussian Elimination, Gaussian Elimination with Scaled Partial Pivoting, Gauss-Jordan Method.	1	3
The Method of Least Squares, Linear Regression, Polynomial Regression, Multiple Linear Regressions.	2	6
Interpolation, Newton's Divided Difference Method Lagrange interpolation, Inverse Interpolation, curve fitting.	1	3
Numerical Differentiation, Finite Difference first and Second Derivatives Approximation, Richardson's Extrapolation.	1	3
Numerical Integration, Trapezoid rule, Romberg Algorithm,	1	3
Ordinary Differential Equations	1	3
Rung- Kutta Methods, Method for Systems of ODE Multi-step Methods.	1	3
Finite Difference Method	1	3

Partial Differential Equations, Elliptic Equations	1	3
Parabolic Equations	1	3
Final Exams	2	6
<b>Total</b>	<b>16</b>	<b>48</b>

<b>EVALUATION</b>		
<b>Assessment Tool</b>	<b>Due Date</b>	<b>Weight (%)</b>
Mid Exam	According to the university calendar	30
Course Work (Homeworks, Quizzes, Projects, ...etc.)	One week after being assigned	20
Final Exam	According to the university calendar	50

<b>General Instructions</b>	
	<b>Additional Notes, office hours, attendance policy, etc....</b>
1	Copying of homework and computer assignments is strictly prohibited and violation will result in a course grade "F". Cheating in quizzes and exams will also result in a course grade "F".
2	Students are encouraged to visit the instructor during the assigned office hours
3	No late homework or make-up examination will be allowed
4	Deferred and incomplete grades will only be given to students with medical or other unforeseen excuse
5	Photocopies of the textbooks are illegal

<b>ABET's Students Learning Outcomes (Criterion # 3)</b>	
	<b>Relationship to program outcomes</b>
<b>ABET 1-7</b>	<b>Engineering Student Outcomes</b>
1	√ an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2	an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3	an ability to communicate effectively with a range of audiences.
4	an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5	an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

6	an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.