Jordan University of Science and Technology

Faculty of Engineering

Aeronautical Engineering Department

AE405 Numerical Methods For Engineers - JNQF Level: 7

First Semester 2023-2024

Course Catalog
3 Credit Hours. Errors in computations, Roots of equations, System of linear algebraic equations including eigenvalue problems, Interpolations and curve fitting, Numerical integration and differentiation, Ordinary differential equations including boundary and initial value problems, Introduction to numerical solution of partial differential equations.

Text Book	
Title	Applied Numerical Methods With MATLAB for Engineers & Scientists
Author(s)	Steven C. Chapra
Edition	5th Edition
Short Name	Text book
Other Information	

Course References

Short name	Book name	Author(s)	Edition	Other Information
Ref#1	Numerical Methods for Engineers	steven chapra; Raymond P. Canale	8th Edition	
Ref#2	Applied numerical analysis	Curtis F. Gerald and Patrick O. Wheatley	4th Edition	
Ref #3	Applied Numerical Methods for Engineers and Scientists	Singiresu S. Rao	4th Edition	

Instructor	
Name	**Dr. Jumah Amayreh**
Office Location	N2 L2

Office Hours	Sun : 11:30 - 13:30 Mon : 08:30 - 09:30 Tue : 10:30 - 12:30 Thu : 08:30 - 09:30
Email	jumah@just.edu.jo

Class Schedule & Room
Section 1: Lecture Time: Sun, Tue, Thu : 09:30 - 10:30 Room: LAB

Prerequisites		
Line Number	**Course Name**	**Prerequisite Type**
713030	AE303 Applied Math For Engineers	Prerequisite / Study
2001140	NE114 Programming For Engineers	Prerequisite / Study

Tentative List of Topics Covered		
Weeks	**Topic**	**References**
Week 1	Introduction to numerical methods	From **Text book**
Week 2	Approximation and sources of Error.	From **Text book**
Week 3	Roots of Equations using Bracketing methods: Bisection and False-position methods	From **Text book**
Week 4	Roots of Equations using open methods: Newton-Raphson, Fixed-point, secant method and Roots of Polynomial	From **Text book**
Week 5	Solving system of linear equations analytically (Gaussian elimination, LU decomposition, Cramer's rule, Matrix inverse) and numerically (Gauss-Seidal and Jacobi).	From **Text book**
Week 6	Curve Fitting: least square regression, general linear least square, and nonlinear regression	From **Text book**
Week 7	Interpolation: Newton's divided- difference and Lagrange interpolating polynomials, spline interpolation	From **Text book**
Week 8	Numerical integration: Trapezoidal and Simpson rules, single and multiple application, integration with unequal segments, multiple integrals.	From **Text book**
Week 9	Numerical differentiation: forward, centered and backward finite-divided difference formulas, unequally spaced data.	From **Text book**
Weeks 10, 11, 12	Solving differential equations: Eular, Heun, mid-point, and general Runge-Kutta methods, system of equations, boundary value problem.	From **Text book**

Weeks 13, 14, 15, 16	Unconstrained Numerical one dimensional Optimization: Golden-section search and quadratic interpolation	From **Text book**

Mapping of Course Outcomes to Program Outcomes and NQF Outcomes	**Course Outcome Weight (Out of 100%)**	**Assessment method**
Employ different root-finding algorithms to find roots of equations and assess their convergence properties. [1SO1] [1L7K1]	10%	
Utilize numerical techniques to solve systems of linear algebraic equations and eigenvalue problems. [1SO1] [1L7K1]	15%	
Develop interpolation schemes and curve fitting methods for given datasets. [1SO1] [1L7K1]	15%	
Implement different numerical techniques for integration and differentiation. [1SO1] [1L7K1]	15%	
Apply numerical methods to solve ordinary differential equations, including both boundary and initial value problems. [1SO1] [1L7K1]	20%	
Implement numerical techniques to solve simple partial differential equations with different boundary conditions. [1SO1] [1L7K1]	10%	
Utilize MATLAB for numerical analysis and engineering problem-solving. [1SO7] [1L7C4]	15%	

Relationship to Program Student Outcomes (Out of 100%)						
SO1	SO2	SO3	SO4	SO5	SO6	SO7
85						15

Relationship to NQF Outcomes (Out of 100%)	
L7K1	L7C4
85	15

Evaluation	
Assessment Tool	**Weight**
First Exam	30%
Second Exam	30%
Final Exam	40%

Policy	
Class attendance	According to university roles, attendance in this course classes is required. You are allowed to be absent at most 20% of the course classes.