Jordan University of Science and Technology

Faculty of Engineering

Biomedical Engineering Department

BME302 Numerical Methods For Engineers

Summer Semester 2019-2020

Course Catalog
3 Credit Hours. 3 Credit hours (3 h lectures). Introduction to strategies in problem solving and mathematical modeling; Understanding flowcharts and how to write computer source codes; Number system representation and machine epsilon; Round-off and truncation errors; Review of Taylor series; Error analysis; Linear system of equations; Non-linear equations; Gauss elimination and iterative methods; Curve fitting and least squares interpolation; Spline interpolation; Numerical integration; Integration of equations; Numerical differentiation; Ordinary differential equations.

Text Book	
Title	Numerical Methods for Engineers
Author(s)	Chapra S. and Canale R.
Edition	6th Edition
Short Name	Textbook
Other Information	

Course References

Short name	Book name	Author(s)	Edition	Other Information
Ref #1	Applied Numerical Analysis	Gerlard C. F. and Wheatly P. O.	6th Edition	

Instructor	
Name	**Razan Shatnawi**
Office Location	-
Office Hours	
Email	rfshatnawi@just.edu.jo

Class Schedule & Room

Section 1:
Lecture Time: Sun, Mon, Tue, Wed : 13:00 - 14:30
Room: منصة الكترونية

Prerequisites		
Line Number	**Course Name**	**Prerequisite Type**
282300	BME230 Tools For Biomedical Engineers	Prerequisite / Study
902030	MATH203 Ordinary Differential Equations	Prerequisite / Study

Tentative List of Topics Covered		
Weeks	**Topic**	**References**
Weeks 1, 2	Introduction to Numerical Methods, Programming and Software. Approximation and Sources of Errors	**chapters 1,2,3 and 4** From **Textbook**
Week 3	Roots of Equations using Bracketing Methods: Bisection and False-Position Methods	**chapter 5** From **Textbook**
Week 4	Roots of Equations using Open Methods: Newton- Raphson, Fixed-Point, Secant Method	**chapter 6** From **Textbook**
Weeks 5, 6	Solving System of Linear Equations Analytically (Gaussian Elimination, LU Decomposition, Cramer's rule, Matrix Inverse) and Numerically (Gauss-Seidal and Jacobi)	**chapters: 9,10 and 11** From **Textbook**
Week 7	Solving Nonlinear System of Equations using Newton-Raphson Method.	From **Textbook**
Weeks 8, 9	Curve Fitting: Least Square Regression, General Linear Least Square, and Nonlinear Regression	**chapter 17** From **Textbook**
Weeks 10, 11	Interpolation: Newton's Divided- Difference and Lagrange Interpolating Polynomials, Spline Interpolation	**chapter 18** From **Textbook**
Weeks 12, 13	Numerical Integration: Trapezoidal and Simpson rules, Single and Multiple Application, Integration with Unequal Segments, Multiple integrals, Integration of Equations.	**chapters:21 and 22** From **Textbook**
Week 14	Numerical Differentiation: Forward, Centered and Backward Finite-Divided Difference Formulas, Unequally Spaced Data.	**chapter 23** From **Textbook**
Weeks 15, 16	Solving Differential Equations: Eular, Heun, Mid-Point, and General Runge-Kutta Methods, System of Equations, Boundary Value Problem.	**chapters: 25 and 26** From **Textbook**

Mapping of Course Outcomes to Program Student Outcomes	**Course Outcome Weight (Out of 100%)**	**Assessment method**
Understand useful computing techniques for solving general and practical engineering problems [1SLO1]	20%	

Estimate numerical errors in application of numerical methods and recognise their importance in real life applications [1SLO1]	20%	
Ability to present numerical results in appropriate fashion [1SLO1]	20%	
Strengthen programming skills using compilers or packages such as MATLAB [1SLO1]	20%	
Ability to solve problems using numerical techniques including those in root finding, linear systems, curve fitting, integration, differentiation, and ODEs [1SLO1]	20%	

Relationship to Program Student Outcomes (Out of 100%)																		
A	B	C	D	E	F	G	H	I	J	K	L	M	SLO1	SLO2	SLO3	SLO4	SLO5	SLO6	SLO7
													100						

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

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