

Detailed Course Description - Course Plan Development and Updating Procedures/ Mathematics Department	QF01/0408-3.0E
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Faculty	Faculty of Science and Information Technology	Department	Mathematics
Course number	0101272	Course title	Numerical Analysis (1)
Number of credit hours	3	Pre-requisite/co-requisite	Calculus (1) (0120121)

Brief course description

This course is designed to introduce the student to a number of numerical methods as well as to teach the student how to do some error analysis. These include methods to approximate roots of functions, to interpolate data points with polynomials and to solve linear systems.

Course goals and learning outcomes	
Goal 1	Introduce the student to various numerical methods
Learning outcomes	1.1 Get introduced to the various methods to approximate roots of functions. 1.2 Get introduced to the types of polynomials used to approximate functions. 1.3 Get introduced to the exact and iterative methods to solve linear systems.
Goal 2	Enable the student to apply error analysis to the numerical methods he is introduced to during the course .
Learning outcomes	2.1 Understand computer arithmetic and types of errors. 2.2 Being able to analyze how and why the algorithms discussed work.

Textbook	"Numerical Analysis", by R. Burden & D. Fairs , 7 th Ed.
Supplementary references	1. "Applied Numerical Analysis", by Gerald & Wheatley , 7 th Ed., (2004), Addison-Wesley Publishing Company. 2. "Numerical Methods: Using Matlab", by John H. Mathews and Kurtis D. Fink, 4 th Ed., (2004) , Prentice-Hall Pub. Inc. 3. "Numerical Methods and Computing", by Cheney & KinCaid , 6 th Ed., (2008), Thomson Learning Academic Resource Center. 4. "Numerical Methodsfor Engineers", by S. K. Gupta, 3 rd Ed., (2013), New Academic Science Ltd, United Kingdom.

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Course timeline			
Week	Number of hours	Course topics	Pages (textbook)
01	1 1 1	Chapter 1: Mathematical Preliminaries Continuity, differentiation, Rules of differentiation. Rolle's Theorem. Mean value theorem. Extreme value theorem. Intermediate value theorem. Bolzano theorem.	2-10
02	1 1 1	Applications of the I.V.T. and Rolle's Theorem to prove the existence and uniqueness of a root of a function.	11-18
03	1 1 1	Chapter 2: Solutions of Equations in One Variable The bisection method. Analysis of the bisection method, error analysis. Applications of the bisection method.	48 - 55
04	1 1 1	The Fixed-Point method: definition, theorem of existence, theorem of uniqueness. Analysis of the Fixed-point method.	55 – 66
05	1 1 1	The Newton-Raphson Method, derivation and applications.	66 – 78
06	1 1 1	The Secant method, derivation and applications. Zeros of Polynomials and multiplicity. Applications. First Exam 20%	78 – 86
07	1 1 1	The Modified Newton method. Horner's Method (synthetic division).	86 – 91
08	1 1 1	Chapter 3: Interpolation and Polynomial Approximation Taylor Polynomial; applications.	107 – 122
09	1 1 1	Interpolation and Lagrange's Polynomial.	107 – 122
10	1 1 1	Iterated Interpolation; Newton's Divided Differences form. Analysis and applications.	122 – 133
11	1 1 1	Chapter 6: Direct Methods for Solving Linear Systems Review of systems and matrices.	345 – 359
12	1 1 1	Second Exam 20% Gaussian Elimination and Backward Substitution, applications. Matrix inversion.	370 – 388

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13	1 1 1	Chapter 7: Iterative Techniques in Matrix Algebra Norms of Vectors and Matrices.	418 – 430
14	1 1 1	Iterative Techniques for Solving Linear Systems. Derivation, analysis, and applications. Jacobi method.	437 - 454
15	1 1 1	Gauss-Seidel method, applications.	437 – 454
16	1 1 1	<u>Final Exam 50%</u>	

Theoretical course evaluation methods and weight	Participation = 10% First exam 20% Second exam 20% Final exam 50%	Practical (clinical) course evaluation methods	Semester students' work = 50% (Reports, research, quizzes, etc.) Final exam = 50%
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Approved by head of department		Date of approval	
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Extra information (to be updated every semester by corresponding faculty member)

Name of teacher	Amal H. Al-Saket	Office Number	9114
Phone number (extension)	430	Email	Amal_saket@zuj.edu.jo
Office hours			