



BIRZEIT UNIVERSITY

## Faculty of Science

### MATHEMATICS DEPARTMENT

#### Course Syllabus

2<sup>nd</sup> Semester 2019/2020

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#### Course information

**Course Code and Number: Math330**

**Course Title: Numerical Methods.**

**Pre requisite: Math234 & ( Comp132 or Comp133 or Comp 142 or Comp 230 )**

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#### Instructors Information

<b>Instructor</b>	Muna Abu Alhalawa	Alaeddin Elayyan	Abdelrahim Mousa
<b>Office</b>	S.Abdulhadi 282	S.Abdulhadi 276	S.Abdulhadi 271

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#### Course Description

Floating point representation and computer arithmetic, numerical solution of nonlinear equation, numerical solutions of systems of linear and nonlinear equations, interpolation and curve fitting and splines, numerical integration and differentiation, numerical solution of initial value problems.

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#### Course goals

This Course is an introductory to Numerical Analysis. It aims to introduce the basic numerical techniques used in several mathematical branches accompanied with MATLAB algorithms.

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#### Course outcomes

Upon completion of Math 330, students will be able to perform the following tasks.

1. Students will be able to comprehend the floating-point system of numbers.
  2. Students will be able to analyze different types and sources of errors.
  3. Students will be able to use iterative techniques to solve nonlinear equations.
  4. Students will be able to solve systems of linear and nonlinear equations numerically.
  5. Students will be able to calculate the cost of computer algorithms.
  6. Students will be able to learn the concept of interpolation and polynomial approximation using Lagrange's and Newton's approaches.
  7. Students will be able to comprehend piecewise interpolation, mainly the cubic spline functions.
  8. Students will be able to apply different methods of curve fitting.
  9. Students will be able to estimate derivatives of all orders at any point.
  10. Students will be able to estimate integrals with high accuracy
  11. Students will be able to use numerical methods to estimate solutions of ODEs.
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## Course Topics and Contents

	Section	Topic
	1.1	Review of Calculus
	1.3	Error Analysis
	2.1	Iteration for Solving $x = g(x)$
	2.2	Bracketing Methods for Locating a Root
	2.3	Initial Approximation and Convergence Criteria
	2.4	Newton-Raphson and Secant Methods
	3.3	Upper-Triangular Linear Systems
	3.4	Gaussian Elimination and Pivoting
	3.5	Triangular Factorization
	3.6	Iterative Methods for Linear Systems
	3.7	Iteration for Nonlinear Systems: Seidel and Newton's Methods
	4.1	Taylor Series and Calculation of Functions
	4.2	Introduction to Interpolation
	4.3	Lagrange Approximation
	4.4	Newton Polynomials
	5.1	Least-Squares Line
	5.2	Methods of Curve Fitting
	5.3	Interpolation by Spline Functions
	6.1	Approximating the Derivative
	6.2	Numerical Differentiation Formulas
	7.1	Introduction to Quadrature
	7.2	Composite Trapezoidal and Simpson's Rule
	7.5	Gauss-Legendre Integration
	9.2	Euler's Method
	9.3	Heun's Method
	9.4	Taylor Series Method
	9.5	Runge-Kutta Methods

## Course assessment detail

Methods of assessment	Relative weight
First Hour Exam	25%
Second Hour Exam	25%
Final Exam	35%
Quizzes & Lab Test	15%

## Course Textbookk

Author	Title	ISBN	Edition	Publisher
John H. Mathews and Kurtis D. Fink	Numerical Methods Using MATLAB	9780130652485	Fourth	PEARSON

## General Guidelines

- 1) **Attendance:** Mandatory. (If you miss more than 4 classes, you get dropped)
- 2) **Cheating:** Immediate course fail with final expulsion possibility.
- 3) **Make Up:**
  - \*There is a makeup exam for the final exam **only**; conditioned with an acceptable excuse via Ritaj portal within 48 hours. Otherwise, the absentee gets **Fail Absent -FA-** (Grade = 50).
  - \* In case of missing **one** of the other exams with acceptable excuses, the formula in the student guide for grades will be used. Otherwise, the absentee gets **zero**.
- 4) **Internet:** Check your personal Ritaj account daily.
- 5) **Calculators:** Bring your own scientific calculator each class.
- 6) **Exams Instructions:**
  - \* Bring your own scientific calculator.
  - \* Mobiles must be set off.
  - \* Personal BZU ID is mandatory.
  - \* Commitment to announced exam's halls at time is a must.
  - \* No cheating whatsoever.
- 7) **Teaching Assistants:** Available daily at S.Abdulhadi 283.
- 8) **Grade formula:** In case of missing one of the two hour exams, the missing grade will be evaluated as follows:

Missing grade = (section's grade of the missing exam × Average student's grade of the other exams) / Average section's grade of the other exams.

## Assigned problems

Section	Problems
1.1	3, 4, 6, 12(a,c)
1.3	1, 2, 5(a,b), 6(a), 7(a), 9
2.1	1(a,b), 2, 3(a,b), 4, 9
2.2	3(a,b), 5, 6, 8,11
2.4	3, 4, 5, 7,8,9, 10
3.3	2, 6
3.4	3, 6, 12, 14(a)
3.5	2(a), 4(b)
3.6	2, 6
3.7	2(a), 6, 7(a)
4.1	1, 2
4.2	1
4.3	2, 3, 5(b,c), 7, 10,11,12
4.4	5, 7, 8
5.1	1(a), 3(a), 8(a), 9(a), 10
5.2	1(a), 3(b), 4(b), 5(b), 8-15
5.3	3, 4, 5, 15(a)
6.1	2, 3, 11
6.2	1(a), 7, 10, 11
7.1	1(a), 2(a), 3, 6
7.2	1(a), 2(c), 8(b), 9(b)
7.5	1, 4
9.2	1, 3
9.3	1, 3
9.4	1, 3
9.5	1, 3