**Faculty of Science**

**MATHEMATICS DEPARTMENT**

**Course Syllabus**

**Semester: Second Semester 2018/2019**

**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**

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| **Instructor**  | Muna Abu Alhalawa | Alaeddin Elayyan | Mahmoud Ghannam |
| **Office** | SCI306 | SCI210 | SCI306 |

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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.

**Course Topics and Contents**

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| **Lecture** | **Section** | **Topic** |
| 1 | 1.1 | Review of Calculus |
| 2 | 1.3 | Error Analysis |
|  |  |  |
| 3,4 | 2.1 | Iteration for Solving $x=g(x)$ |
| 5 | 2.2 | Bracketing Methods for Locating a Root |
| 6 | 2.3 | Initial Approximation and Convergence Criteria |
| 7,8 | 2.4 | Newton-Raphson and Secant Methods |
|  |  |  |
| 9 | 3.3 | Upper-Triangular Linear Systems |
| 10,11 | 3.4 | Gaussian Elimination and Pivoting |
| 12,13 | 3.5 | Triangular Factorization |
| 14 | 3.6 | Iterative Methods for Linear Systems |
| 14 | 3.7 | Iteration for Nonlinear Systems: Seidel and Newton’s Methods  |
|  |  |  |
| 15 | 4.1 | Taylor Series and Calculation of Functions |
| 15 | **4.2** | Introduction to Interpolation |
| 16 | 4.3 | Lagrange Approximation |
| 17 | 4.4 | Newton Polynomials |
|  |  |  |
| 18 | 5.1 | Least-Squares Line |
| 19 | 5.2 | Methods of Curve Fitting |
| 20 | 5.3 | Interpolation by Spline Functions |
|  |  |  |
| 21,22 | 6.1 | Approximating the Derivative |
| 23,24 | 6.2 | Numerical Differentiation Formulas |
|  |  |  |
| 25,26 | 7.1 | Introduction to Quadrature |
| 27 | 7.2 | Composite Trapezoidal and Simpson’s Rule |
| 28 | 7.5 | Gauss-Legendre Integration |
|  |  |  |
| 29 | 9.2 | Euler’s Method |
| 29 | 9.3 | Heun’s Method |
| 30 | 9.4 | Taylor Series Method |
| 30 | 9.5 | Runge-Kutta Methods |

**Course assessment detail**

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| **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 SCI309.
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** |