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| **Jerash University** **Faculty of Science****Department of Science/Mathematics****Second Semester 2019-2020** | **C:\Users\HP\Dropbox\Jarash University\Jarash Logo.jpg** |

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| **Course Information** |
| **Course Title** | Numerical Analysis 1 |
| **Course Number** | 303321 |
| **Prerequisites** |  Calculus 2 (303102) |
| **Instructor** |  |
| **Office Location**  |  |
| **Office Hours** |  |
| **E-mail** |  |
| **Course Description**  |
| Error analysis, numerical solution of equations in one variable, interpolation and polynomial approximation, numerical differentiation and integration. |

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| **Text Book** |
| **Title** | Numerical Analysis  |
| **Author(s)** | Richard L.Burden and J.Doglas Fairs |
| **Publisher** | Thomson learning |
| **Year** | 2011 |
| **Edition** | Ninth Edition  |
| **References** | 1. J. Stoer and R. Bulirsch, *Introduction to Numerical Analysis*, Springer-Verlag.
2. L.N. Trefethen and D. Bau, *Numerical Linear Algebra*, Society of Industrial and Applied Mathematics.
3. C.T. Kelley, *Iterative methods for linear and nonlinear equations*, Society of Industrial and Applied Mathematics
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| **Assessment Policy** |
| **Assessment Type** | **Expected Due Date** | **Weight** |
| **First Exam** | To be announced by the department | 20% |
| **Second Exam** | To be announced by the department | 20% |
| **Final Exam** | To be announced by the department. | 40% |
| **Assignment**  | Five assignments will be considered  | 20% |
| **Over all** |  | 100% |

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| **Course Objectives** |
| 1. Studying the error and the convergence for many numerical methods.
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| 1. Approximating the root of a function by different numerical methods.
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| 1. Finding the interpolating polynomial by different methods.
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| 1. Deriving numerical methods for differentiation and integration.
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| 1. Analyzing and evaluating the accuracy of common numerical methods.
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| **Course Outcomes** |
| 1. Working with computer, particularly Mathematica, to solve problems numerically.
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| 1. Developing an appreciation for the applicability of the Mathematics theorems and rules to the real world.
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| 1. Appling numerical analysis in solving problems from Physics and Chemistry.
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| 1. Comparing between numerical methods.
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| 1. Developing an appreciation for numerical analysis.
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| **Weekly Course Outlines** |
| **Week** | **Topics** | **Chapter in Text (handouts)** |
| 1 | **Mathematical Preliminaries and Error Analysis** | Chapter 1 |
| 1.1 Review of Calculus 1.2 Round-off Errors and Computer Arithmetic |
| 2-5 | **Solutions of Equations in One Variable**  |  |
| 2.1 The Bisection Method 2.2 Fixed-Point Iteration2.3 Newton’s Method and Its Extensions2.4 Error Analysis for Iterative Methods2.5 Accelerating Convergence2.6 Zeros of Polynomials and Müller’s Method  | Chapter 2 |
| **First Exam** |
| 6-8 |  **Interpolation and Polynomial Approximation** | Chapter 3 |
| 3.1 Interpolation and the Lagrange Polynomial3.2 Data Approximation and Neville’s Method 3.3 Divided Differences 3.4. Hermite Interpolation  |
| 12- 9 | **Numerical Differentiation and Integration** |  |
| 4.1 Numerical Differentiation4.2 Richardson’s Extrapolation 4.3 Elements of Numerical Integration4.4 Composite Numerical Integration | Chapter 4 |
| **Second Exam** |
| 13-15 | 4.5 Romberg Integration4.6 Adaptive Quadrature Methods4.7 Gaussian Quadrature4.8 Multiple Integrals4.9 Improper Integrals | Chapter 4 |

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| **Outcomes** | **Teaching Strategies** | **Learning activities** | **Assessments** | **Evaluation** |
| Working with computer algebra systems, particularly Maple, to solve problems numerically. | Lectures | Exercises, Discussion | Exams Mathematica Assignments  | Final Exams |
| Recognizing the idea of order of convergence.  | Lectures | Exercises, Discussion | Exams  | Final Exams |
| Appling numerical analysis in solving problems from Physics and Chemistry.  | Lectures | Exercises, Discussion | Exams  | Final Exams |
| Comparing between numerical methods.  | Lectures | Exercises, Discussion | Exams Mathematica Assignments  | Final Exams |
| Developing an appreciation for numerical analysis. | Lectures | Exercises, Discussion | Exams  | Final Exams |