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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. |
| 1. Approximating the root of a function by different numerical methods. |
| 1. Finding the interpolating polynomial by different methods. |
| 1. Deriving numerical methods for differentiation and integration. |
| 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. |
| 1. Developing an appreciation for the applicability of the Mathematics theorems and rules to the real world. |
| 1. Appling numerical analysis in solving problems from Physics and Chemistry. |
| 1. Comparing between numerical methods. |
| 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 Iteration  2.3 Newton’s Method and Its Extensions  2.4 Error Analysis for Iterative Methods  2.5 Accelerating Convergence  2.6 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 Polynomial  3.2 Data Approximation and Neville’s Method  3.3 Divided Differences  3.4. Hermite Interpolation |
| 12- 9 | **Numerical Differentiation and Integration** |  |
| 4.1 Numerical Differentiation  4.2 Richardson’s Extrapolation  4.3 Elements of Numerical Integration  4.4 Composite Numerical Integration | Chapter 4 |
| **Second Exam** | | |
| 13-15 | 4.5 Romberg Integration  4.6 Adaptive Quadrature Methods  4.7 Gaussian Quadrature  4.8 Multiple Integrals  4.9 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 |