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| **logo University of Management & Technology**  School of Science & Technology  Department of Mathematics | | | |
| MA-222 Numerical Analysis | | | |
| **Lecture Schedule** |  | **Semester** | Spring 2013 |
| **Credit Hours** | Three | **Pre-requisite** | Applied Calculus  Linear Algebra  Differential Geometry |
| **Instructor** | Dr. Aziz ur Rehamn  /Raja Noshad Jamil | **Contact** | [aziz.rehman@umt.edu.pk](mailto:aziz.rehman@umt.edu.pk)  [noshad.jamil@umt.edu.pk](mailto:noshad.jamil@umt.edu.pk) |
| **Office** | 2nd Floor, SST Hall | **Office Hours** | See Office Window |
| **Teaching Assistant** | - | **Contact** | - |
| **Office** | N/A | **Office Hours** | N/A |
| **Course Description** | The purpose of numerical analysis is two-fold: (1) to find acceptable approximate solutions when exact solutions are either impossible or so tough and time-consuming as to be impractical, and (2) to devise alternate methods of solution better suited to the capabilities of computers.  While this course will involve the student in considerable computation in order to apply techniques and obtain acceptable answers, the main emphasis will be on the underlying theory. It will be necessary to draw upon a good bit of calculus, linear algebra, computer science and other branches of mathematics during the course.  To understand the basic techniques of numerical analysis for solving nonlinear algebraic equations, interpolation, for numerical differentiation and integration.  To be able to set up computational algorithms for the solution of above problems.  To be able to use MATLAB software package. | | |
| **Expected Outcomes** | In accordance with HEC curriculum **outcomes** a, b, d, e, g, h & i, students at the end of the course should be able to   * Participants have begun to appreciate the role of reasoning in mathematics and computer programming. * They have become familiar with the tools used in counting. * They have started understanding the difference between a general proof and verification in particular cases. | | |
| **Text/**  **Reference**  **books** | * Burden, R.L. and Faires, D.F., Numerical Analysis, 5th ed. PWS-Kent, Boston, MA * Steven C. Chapra and Raymond P. Canale, “Numerical Methods for Engineers,” Fifth Edition, 2006, McGraw-Hill, ISBN: 0073101567. * Curtis F. Gerald, “Applied Numerical Analysis,” Seventh Edition, 2003, Addison Wesley, ISBN: 0321133048 * Saeed Bhatti and Naeem Bhatti :A First Course in Numerical Analysis , Fourth edition,   2003, Shahryar Publishers, Urdu Bazar Lahore.) | | |
| **Grading Policy** | * Computer programming: 15% * Quizzes: 15% * Midterm: 30% * Final: 40% | | |

**Tentative Schedule**

**Lectures, Reading Assignments, Homework Assignments**

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| **Wk** | **Chapter** | **1st Lecture**  **Topic to Cover** | **Section** | **2nd Lecture**  **Topic to Cover** | **Section** |
| 1 | 1 | Review of Calculus.  What is Numerical Analysis?  Why Numerical Techniques?  Floating point number systems | 1.1 | Definition of error; Relative and Absolute errors. Sources of Errors. Classification of errors: Gross errors, Rounding errors, Truncation errors. | 1.2 |
| 2 | 2 | Various methods of root-finding: graphical and iteration methods. Graphical representation of iteration method. | 2.1 | Bisection method and its Computational algorithms | 2.1 |
| 3 | 2 | The method of false position and secant method. Computational algorithms for these methods. | 2.2,2.3 | The derivation of the Newton-Raphson formula, error in N-R method. Limitations of N-R method. Computational algorithm for N-R method. | 2.3 |
| 4 | 2,6 | Error Analysis for Iterative Methods | 2.4 | Linear Systems of Equation, Pivoting Strategies | 6.1, 6.2 |
| 5 | 7 | The Jacobi Method, Illustration of the method by examples; Design an algorithm for Jacobi’s method | 7.3 | Gauss-Seidel method, Illustration of the method by examples; Design an algorithm for Gauss-Seidel’s method | 7.3 |
| 6 |  | Method of least squares |  | Eigen value and Eigen vectors |  |
| 7 | 3 | Introduction to interpolation. Interpolation using equally-spaced data points. | 3.1 | Difference table. Detection and correction of errors in difference table. Difference operator. | 3.1 |
| 8 | 3 | Relationships between Difference operators. | 3.2 | Interpolation using unequally-spaced data points. | 3.2 |
| 9 | 3 | Newton’s forward difference, backward difference and central difference interpolation formulas. | 3.2 | Cubic Spline interpolation. | 3.3 |
| 10 | 4 | Cubic Spline interpolation. | 3.3 | Introduction to Numerical Differentiation | 4.1 |
| 11 | 4 | Approximation of derivatives using Newton’s forward, backward and central difference formulas. | 4.3 | Introduction to numerical integration, Trapezoidal Rule and its Algorithms. | 4.3 |
| 12 | 4 | Simpson’s 1/3 method with algorithm. | 4.3 | Simpson’s 3/8 method with algorithm | 4.3 |
| 13 | 4 | Exercises on Numerical differentiation and integration | 4.1, 4.2 | Exercises on Numerical differentiation and integration | 4.3,4.4 |
| 14 | 4 | Numerical solution ordinary  Differential Equations | 4.1, 4.2 | Numerical solution ordinary  Differential Equations | 4.3,4.4 |
|  |  | Numerical solution partial  Differential Equations |  | Numerical solution partial  Differential Equations |  |
| 15 | Revision | | | | |