***DIRE DAWA UNIVERSITY***

***COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCE***

***DEPARTMENT OF MATHEMATICS***

*Course title: Numerical Analysis Course code: Math – 2082*

*Credit Hrs: 3 ECTS: 5 Lecture Hrs.: 3 Lab. Hrs.: 2 Tut. Hrs.: 2*

*Prerequisite: Applied Mathematics I(Math1041) Target Group: Comp. Science Year: II Semester: II*

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*Course outline*

***Chapter 1: Basic concepts in error estimation (12 hrs)***

* 1. Sources of errors
  2. Approximations of errors
  3. Rounding off errors
  4. Absolute and relative errors
  5. Propagation of errors
  6. Instability

***Chapter 2: Nonlinear equations (8 hrs)***

* 1. Locating roots
  2. Bisection and False – position methods
  3. Interpolation and Secant methods
  4. Iteration Methods
  5. Conditions for convergence
  6. Newton-Raphson Method

***Chapter 3: System of equations (9 hrs****)*

*3.1 Revision on direct methods for system of linear equations (SLE)*

*3.2 Indirect methods for SLE*

*3.2.1 Gauss Jacobi method*

*3.2.2 Gauss Seidel method*

*3.3 Systems of non-linear equations using Newton's method*

***Chapter 4: Finite differences (9 hrs****)*

*4.1 Shift operators*

*4.2 Forward difference operators*

*4.3 Backward difference operators*

*4.4 Central difference operators*

***Chapter 5: Interpolations (9 hrs)***

*5.1 Linear interpolation*

*5.2 Quadratic interpolation*

*5.3 Lagrange’s interpolation formula*

*5.4 Divided difference formula*

*5.5 Newton interpolation formula (forward and backward formulas)*

***Chapter 6: Application of interpolations (5 hrs)***

*6.1 Finding roots*

*6.2 Numerical Differentiation*

*6.3 Numerical Single Integration*

*6.3.1 Trapezoidal rule*

*6.3.2 Simpson's rule*

*6.3.3 Error analysis in Trapezoidal and Simpson’s rules*

*6.4 Numerical Double Integration*

*6.4.1 Trapezoidal rule*

*6.4.2 Simpson's rule*

*6.4.3 Error analysis in Trapezoidal and Simpson’s rules*

***Assessment methods***

* Computer Lab./ Assignments/ Quizzes – 20%
* Mid semester Examination – 30%
* Final Examination – 50%

***Teaching materials***

***Textbooks****:*

* Burden, R. L. & Faires, J. D. (2005). Numerical analysis. 8 th ed. Thomson Brooks/Cole.
* Chapra S.C.& Canale R.P.(2010).Numerical methods for engineers. Boston: McGraw-Hill Higher Education.
* Gerald, C. F. and Wheatlly, P. O. (2018). Applied Numerical analysis. 7 th ed., Edsion Wesley, Co.

***References:***

* Atkinson, K. E. (2008). An introduction to numerical analysis. John wiley & sons.
* Chapra, S.C. and Raymond, P.C. (1998). Numerical Methods for Engineering. 9 th ed.,McGraw-Hill, New York.
* Gerald, C.F. & Wheatley, P.O. (1994). Applied Numerical Analysis. 5 th ed., Edison Wesley.
* Grewal, B.S. (1994). Numerical Methods in Engineering and Science. Khanna, New Delhi.
* Kiusalaas, J. (2005). Numerical methods in Engineering with MATLAB. Cambridge University Press.
* Ralston, A., & Rabinowitz, P. (2001). A first course in numerical analysis. Courier Corporation.
* Shanthakumar, M. (1987). Computer Based Numerical Analysis. Mysore.
* Stoer, J., & Bulirsch, R. (2013). Introduction to numerical analysis (Vol.12). Springer Science & Business Media.
* Yang, Won-young (2005). Applied Numerical Methods Using MATLAB. John Wiley & Sons