DEREE COLLEGE SYLLABUS FOR: MA 3232 NUMERICAL METHODS	3/1/3
(Fall 2025)	**UK LEVEL: 5** **UK CREDITS: 15**

PREREQUISITES:	MA1024 Algebra & Trigonometry **or** MA1008 College Algebra **or** ITC3006 Mathematics for Computing MA2131 Calculus I **or** MA2105 Applied Calculus
CATALOG DESCRIPTION:	This course provides a practical introduction to numerical methods of approximating solutions to linear and nonlinear problems in the applied sciences. Topics covered include numerical techniques for solving a single nonlinear equation, polynomial interpolation, numerical differentiation and integration, solution of initial value problems, and the solution of systems of linear and non-linear equations.
RATIONALE:	This course is an introduction to numerical analysis and scientific computing. The primary objective of the course is to develop a basic understanding of numerical techniques and theories in computational mathematics and to develop skills for creating algorithms for solving mathematical problems on the computer. Students will gain experience in implementing and observing the numerical performance of the various numerical methods using a math programming language.
LEARNING OUTCOMES:	*As a result of taking this course, the students should be able to:* 1. Demonstrate understanding of the use of numerical algorithms and concepts related to complexity, stability, and convergence. 2. Apply various numerical methods for solving non-linear equations and understand the use of numerical computations to implement these methods. 3. Apply numerical differentiation and integration, and compute approximate solutions of ordinary differential equations. 4. Utilize numerical techniques to solve large systems of equations and evaluate accuracy and stability.
METHOD OF TEACHING AND LEARNING:	In congruence with the teaching and learning strategy of the college, the following tools are used: • Lectures and class discussions. • Homework assignments. • Office hours held by the instructor to provide further assistance to students. • Use of library facilities for further study and preparation for the exams • Use of the Blackboard course management platform to further support communication, by posting lecture notes, assignment instruction, timely announcements, formative quizzes and online submission of assignments.
ASSESSMENT:	**Summative:** 1st Assessment: Midterm Examination (1 hour written) — **40%** 2nd Assessment: Portfolio of student work — **10%** Final Assessment: Final Examination (2 hours written) — **50%** ▪ The first assessment tests Learning Outcomes 1 and 2. ▪ The second assessment tests Learning Outcomes 1, 2, 3, and 4. ▪ The final assessment tests Learning Outcomes 1, 2, 3, and 4. ▪ The formative assessment aims to prepare students for the examinations. The final grade for this module will be determined by averaging all summative assessment grades, based on the predetermined weights for each assessment. If students pass the comprehensive assessment that tests all Learning Outcomes for this module and the average grade for the module is 40 or higher, students are not required to resit any failed assessments. Students are required to resit failed assessments in this module.

INDICATIVE READING:	**REQUIRED READING:** • R. L. Burden, J. Douglas Faires, A. M. Burden, *Numerical Analysis*, 10th Edition, 2016, Cengage **RECOMMENDED READING:** • Timothy Sauer, *Numerical Analysis*, 3rd Edition, 2018, Pearson • D. R. Kincaid and E. Ward Cheney, *Numerical Analysis: Mathematics of Scientific Computing*, 3rd Edition, 2002, Brooks/Cole Publishing Co.
INDICATIVE MATERIAL:	**REQUIRED MATERIAL:** N/A **RECOMMENDED MATERIAL:** • College Mathematics • Mathematics Magazine • American Mathematical Monthly
COMMUNICATION REQUIREMENTS:	Oral and written communication skills using academic / professional English.
SOFTWARE REQUIREMENTS:	MS Office and Blackboard CMS. Any software distributed with the course textbook. Python (www.python.org) *or* GNU Octave (www.octave.org)
WWW RESOURCES:	http://mathworld.wolfram.com http://sosmath.com https://www.khanacademy.org/math https://www.symbolab.com
INDICATIVE CONTENT:	**1. Basic Concepts in Computing** 1.1 Round-Off Errors and Floating-Point Arithmetic 1.2 Convergence and Stability 1.3 Numerical Algorithms and Software **2. Numerical Solutions of Equations in One Variable** 2.1 The Bisection Method 2.2 Fixed-Point Iteration 2.3 The Newton-Raphson Method 2.4 Error Analysis for Iterative Methods 2.5 Computing Zeros of Polynomials **3. Interpolation and Polynomial Approximation** 3.1 Interpolation using Lagrange Polynomials 3.2 Divided Differences 3.3 Cubic Spline Interpolation 3.4 Discrete Least Squares Approximation **4. Numerical Differentiation and Integration** 4.1 Numerical Differentiation 4.2 Numerical Integration and Newton-Cotes Formulas 4.3 Gaussian Quadrature **5. Numerical Solutions of Ordinary Differential Equations** 5.1 Initial-Value Problems 5.2 Euler's Method 5.3 Higher-Order Taylor Methods 5.4 Runge-Kutta Methods **6. Direct Methods for Solving Linear Systems** 6.1 Linear Systems and Pivoting Strategies 6.2 Matrix Factorization Methods **7. Numerical Solutions of Nonlinear Systems*** 7.1 Fixed Points for Multivariate Functions 7.2 Newton's Method 7.3 Steepest Descent Techniques * If time permits