Course Code: MAT 481

Course Title: **Numerical Methods**

Credit Weight: 3.0 Credits

Rationale of the Course:

This course focuses on the concept of numerical analysis for the different scientific and engineering problem-solving techniques. In this course, the student will explore different types of Numerical solutions of different mathematical methods.

Prerequisite: MAT250

Course Objective:

1. To brief about numerical analysis and usefulness for the mathematician and engineers.
2. To learn the theoretical background of different scientific and engineering problem-solving techniques.
3. To explore different types of Numerical solutions of different mathematical methods.
4. To learn algorithms for the different numerical methods for writing computer code using the programing language FORTRAN/C/C++/MATLAB.

Course Learning Outcomes (CLOs)/Course Outcomes (COs):

At the successful completion of this course, the student will have demonstrated the ability to:

(CLO1) describe the usefulness of numerical methods to solve different scientific problems.
(CLO2) describe the different numerical methods for the different mathematical problems.
(CLO3) Identify the different types of numerical methods for the different mathematical problems.
(CLO4) to write the computer code for the different numerical methods.

Course Contents:

Introduction: Basic concepts of numerical analysis, error analysis, norm calculation and convergence criteria.

Solution of Algebraic and Transcendental Equation: Bisection method, Muler's method, Newton-Raphson method. Interpolation: Newton forward and backward difference, Gauss Central Difference formula.

Numerical differentiation: Forward, backward and central differentiation. Differentiation of the numerical data based on the Newton forward and backward interpolation formula.

Numerical integration: General Quadrature formula, trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule. Solution of system of linear equation: *Direct method*: Matrix inversion method, Gaussian elimination method; LU factorization method.

Solution of system of linear equation: *iterative method*: Jacobi method, Gauss-Seidel method, SOR method.

Solution of first order Initial value problem (ordinary differential equation): Euler's method, Runge-Kutta 2nd and 4th order method.

Text Book: (1) Numerical Analysis: Rechard L. Burden and J. Douglas Faires, 9th Edition
(2) Numerical Mathematics and Computing, W. Cheney, D. Kincaid, 6th Edition
(3) Numerical Methods using MATLAB, 4th edition by Johm H.

Mapping Course Learning Outcomes (CLOs) with the PLOs
Table 1 Relationship between PLOs and PEOs

CLOs	PLO(a): Mathematical Knowledge	PLO(b): Problem Analysis	PLO(c): Development/Design Solutions	PLO(d): Investigation and Make Decision	PLO(e): Usage of Modern Tools of Computation	PLO(f): Professionalism and sustainability	PLO(g): Ethics	PLO(h): Individual work and teamwork	PLO(i): Communication	PLO(j): Life-long Learning
CLO1	S	S	M							
CLO2	S	S	S	S	L					
CLO3	S	M	M	M				L	L	L
CLO4	L	M	L	S			M	M	L	L

Note: S: Strong correlation, M: Medium correlation, L: Low correlation

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	Teaching Strategies						Assessment Strategies						
	Class Lecture	In -class Q/A	Group discussions	Assignments/ Homework	In-class problem solution	Computer Lab works	Continuous Assessments	Quizzes	Written exams (Midterm/Final)	Home Assignments	Oral Viva	Presentations	Lab Report
CLO1	√	√		√			√	√					
CLO2	√		√	√	√			√	√				
CLO3	√	√	√	√			√				√		
CLO4	√	√	√		√	√	√		√			√	

Course Assessment Policy:

Course Assessment System:	Attendance	10%
	Assignments (Minimum 4)	10%
	Quizzes (Best 3 of 5)	20%
	Mid-Term	20%
	Final Exam	40%
Grading Policy:	As per the NSU grading system.	
Attendance Policy:	As per NSU policy.	

Exams & Make-up Exam Policy

NO makeup for quizzes and NO Formative assessment will be retaken under any circumstances. If a student misses the Midterm and/or Final exams due to circumstances beyond their control (official valid documents are required) and is informed beforehand (if possible), a reasonable arrangement may be considered. Please note that the retake exam questions are generally a bit tricky and critical compared to the regular exam questions. **Students may get the opportunity to see/recheck their midterm and Final exam scripts. Cell phones are prohibited in exam sessions**.