Course Specification

(Bachelor)

Course Title:	**Numerical Analysis 1**
Course Code:	**316MATH-3**
Program:	**B. Sc. in Mathematics**
Department:	**Mathematics**
College:	**Science**
Institution:	**Jazan University**
Version:	**2024**
Last Revision Date:	**9/2024**

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours:	3

2. Course type

A.	University ☐	College ☐	Department☒	Track☐	Others☐
B.	Required ☒		Elective☐		

3. Level/year at which this course is offered:

Level 5/ Year 3

4. Course general Description

This course is designed to provide students with

- **Errors:** Classification of errors, approximation of numbers, theorems on errors.
- **Methods of Solving Algrbraic and Transcendental Equations :** Bisection method, secant method, Newton-Raphson method, method of convergence approximation and error calculation in each method.
- **Numerical Solution of Systems of Linear Algebraic Equations :** Gauss method, Gauss-Jordan method, LU-factorization method, Gauss-Jacobi method, Gauss-Seidel method, Method of eigenvalues.
- **Numerical Solution of Systems of Nonlinear Algebraic Equations :** Newton's method, method of convergence approximations.
- **Interpolation(Function Approximation):** Lagrange's and Newton's divided difference method, forward-difference and backward-difference interpolation formulae, inverse interpolation.
- **Numerical Differentiation and Integration:** Numerical derivatives, trapezoidal rule, Simpson's method, Gauss-quadrature method.
- **Numerical Solution of Differential Equations of First Order**: Euler's method, Euler's improved method, Runge-Kutta method.

5. Pre-requirements for this course (if any): 212 Math

6. Co- requirements for this course (if any): None

7. Course Main Objective(s)

After finishing the course, the student is expected to be familiar with the following:

- Numerical methods to solve algebraic equations
- Various numerical methods to solve system of linear equations
- Interpolation methods in the approximation of functions
- Numerical methods to find numerical differentiation and integration of functions
- Numerical methods in solving ordinary differential equations of first order
- Some Software (Matlab - Mathematical) in numerical solutions.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1.	Traditional classroom	45	100
2.	E-learning		
3.	Hybrid • Traditional classroom • E-learning		
4.	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	42
2.	Laboratory/Studio	
3.	Field	
4.	Tutorial	3
5.	Others (specify)	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Distinguish mathematical concepts relevant to linear and nonlinear equations, interpolation, integration, and numerical solution of differential equations of first order.	K1	Lectures, Web based work, Classroom discussion.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments.
1.2	Identify background science, features and structures of Mathematics problems in errors, linear and nonlinear equations, interpolation, integration, and numerical solution of differential equations of first order.	K2	Lectures, Web based work, Classroom discussion.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments.
1.3	Explain notations and concepts required for the solution of errors, linear and nonlinear equations, interpolation, integration, and	K3	Lectures, Web based work, Classroom discussion.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	numerical solution of differential equations of first order.			
2.0	**Skills**			
2.1	Apply theoretical, computational or practical aspect relevant to errors, linear and nonlinear equations, interpolation, integration, and numerical solution of differential equations of first order.	S1	Lectures, problem solving, web based work, Classroom discussion.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments.
2.2	Compute numerical quantities for various parameters to approximate the solution in errors, linear and nonlinear equations, interpolation, integration, and numerical solution of differential equations of first order.	S2	Lectures, problem solving, web based work, Classroom discussion.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments.
2.3	Apply various mathematical rules, techniques and theorems in errors, linear and nonlinear equations, interpolation, integration, and numerical solution of differential equations of first order.	S3	Lectures, problem solving, web based work, Classroom discussion.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments.
2.4	Solve mathematical problem using critical thinking for linear and nonlinear equations and numerical solution of differential equations of first order.	S4	Lectures, problem solving, web based work, Classroom discussion.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments.
3.0	**Values, autonomy, and responsibility**			
3.1	Cultivate a mathematical attitude and nurture the interest.	V1	Group work, problem solving, web-based work.	Assignments, Discussion.
3.2	Realize the importance of responsibilities through different modes of practice, competition and related activities.	V2	Group work, problem solving, web-based work.	Assignments, Discussion.
3.3	Inculcating values and ethics in thought, expression and deed.	V3	Group work, problem solving, web-based work.	Assignments, Discussion.

C. Course Content

No	List of Topics	Contact Hours
1.	Errors	5
2.	Roots of non-linear equations	5
3.	Linear and non-linear Systems	11
4.	Polynomial Interpolation	7
5.	Numerical Differentiation	7
6.	Numerical Integration	5
7.	Initial Value Problems (First Order	5
Total		**45**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework and Quiz	3	5
2.	First exam	6	20
3.	Homework and Quiz	10	5
4.	Second exam	12	20
5.	Final exam	15	50

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Numerical Methods with Applications by Autar Kaw and Egwu Eric Kalu, Publisher: Lulu.com 2008.
Supportive References	• Numerical Analysis, V. A. Patel, Harcourt Brace, College Publishers, (1994). Numerical Mathematics and Computing, W. Cheney and D. Kincaid, Brooks / Cole Publishing Company, (2003).
Electronic Materials	Web sites dedicated to Numerical Methods available on the internet
Other Learning Materials	- Numerical Methods packages - Power point presentations and other hand outs posted on the course web site.

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom, Computer Lab.
Technology equipment (projector, smart board, software)	Data show; Smart Board, Mathematics software.
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (Course Evaluation Survey)- Indirect peer evaluation
Effectiveness of students assessment	Students, Program assessment committee	Direct/ Indirect
Quality of learning resources	Instructor	Direct/Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data

COUNCIL /COMMITTEE	**Board Of Mathematics Department**
REFERENCE NO.	**2417**
DATE	**29/03/1446 A. H.; 2/10/2024 A. D.**