Course Specification
(Bachelor)

Course Title:	**Numerical Analysis II**
Course Code:	**419MATH-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:	

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

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

Level 8 / Year 4

4. Course general Description

This course is designed to provide students with

- **Numerical solution of systems of differential equations** (numerical solution of systems of differential equations of first order,Taylor ,Euler and Range-Kutta methods.
- **Numerical solution of differential equations with higher-order,** Reduction in rank translate to equations of first order, Taylor ,Euler , Heun's and Range-Kutta methods.
- **Introduction in the Partial differential equations and numerical methods**
- **Numerical solution of partial differential equations** (Dalimber method of Changing variables, Finite differences method, numerical solution of partial differential equations (elliptic and hyperbolic and parabola).
- **Approximation of eigenvalues and eigenvectors:** Power method.

5. Pre-requirements for this course (if any): 434 MATH

6. Co- requirements for this course (if any):

7. Course Main Objective(s)

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

- Known partial differential equations and numerical methods for solving them.
- Use of numerical methods to solve system of ordinary differential equations.
- Use of numerical methods in solving ordinary differential equations of higher order.
- Use of numerical methods in solving Partial differential equations.
- Use of numerical methods to approximate eigenvalues and eigenvectors.
- Use of some software (Matlab – Mathematica and others) in solving ordinary and partial differential equations.

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 Methods of solve differential equations, Partial differential equations, Approximating Eigen values and Least Square Method.	K1	Lectures, problem solving, web based work, Classroom discussions	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
1.2	Identify background science, features and structures of Mathematics problems in Methods of solve differential equations, Partial differential equations, Approximating Eigen values and Least Square Method.	K2	Lectures, problem solving, web based work, Classroom discussions	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
1.3	Explain notations and concepts required for the solution of	K3	Lectures, problem solving, web based	Written exam (Problem solve,

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	Methods of solve differential equations, Partial differential equations, Approximating Eigen values and Least Square Method.		work, Classroom discussions	MCQ, true/false, Proof, Short answer), Quizzes, Assignments
2.0	Skills			
2.1	Apply theoretical, computational or practical aspect relevant to Methods of solve differential equations, Partial differential equations, Approximating Eigen values and Least Square Method.	S1	Lectures, problem solving, web based work, Classroom discussions	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 Methods of solve differential equations, Partial differential equations, Approximating Eigen values and Least Square Method.	S2	Lectures, problem solving, web based work, Classroom discussions	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
2.3	Apply various mathematical rules, techniques and theorems in Methods of solve differential equations, Partial differential equations, Approximating Eigen values and Least Square Method.	S3	Lectures, problem solving, web based work, Classroom discussions	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
2.4	Solve mathematical problem using critical thinking for Methods of solve differential equations, Partial differential equations, Approximating Eigen values and Least Square Method.	S4	Lectures, problem solving, web based work, Classroom discussions	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 and discussion

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
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 and discussion
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C. Course Content

No	List of Topics	Contact Hours
1.	Revision on the methods of numerical solutions of first order initial value problems, numerical Solution of System of first order initial value problems	9
2.	Numerical Solution of Second and higher order initial value problem	9
3.	Least Square Method	6
4.	Numerical solution of Partial Differential Equations.	12
5.	Approximating Eigenvalues	9
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.**