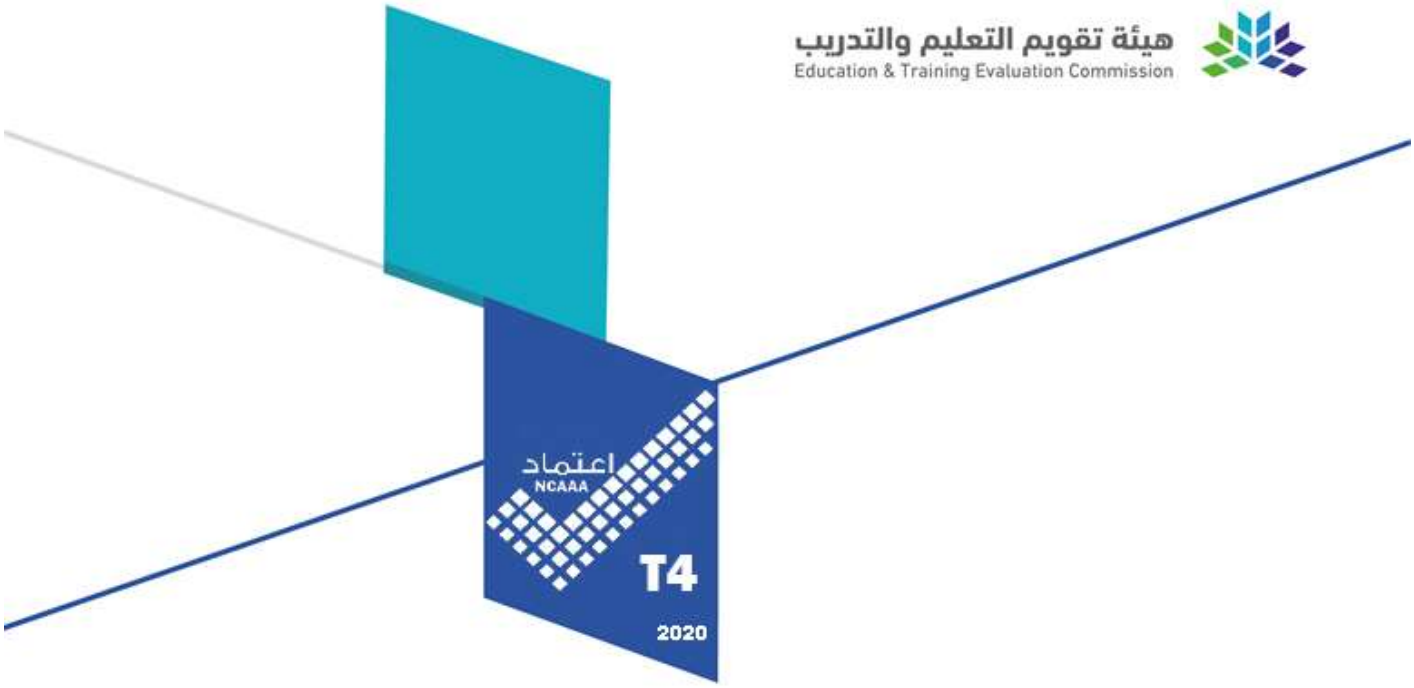
هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission



Course Specifications

Course Title:	**Numerical Analysis II**
Course Code:	**419 Math**
Program:	**B. Sc. in Mathematics**
Department:	**Mathematics**
College:	**Science**
Institution:	**Jazan University**

Table of Contents

A. Course Identification

1. Credit hours: 3
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: Level 8/Year 4
4. Pre-requisites for this course (if any)**: 434 MATH**
5. Co-requisites for this course (if any)**:**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	45	100%
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	**42**
2	**Laboratory/Studio**	
3	**Tutorial**	**3**
4	**Others** (specify)	
	Total	**45**

B. Course Objectives and Learning Outcomes

1. Course Description

This course is designed to provide students with

- **Numerical Solution of Systems of Differential Equations:** Numerical solution of system of differential equations of first order and higher-order, Reduction in rank translate to equations of first order, application of software in numerical solutions of differential equations.
- **Numerical Solution of Partial Differential Equations**: Fourier method to separate variables, D'Alembert method to change variables, open manner, Crank-Nicholson method, numerical solution of partial differential equations (elliptic, hyperbolic and parabolic), methods of solving of partial differential equations of first and second order, the general solution (Fourier method and, D'Alembert method &use the software to find the solution).
- **Systems of Partial Differential equations.**
- **Difference Equations.**

2. Course Main Objective

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

- Numerical methods to solve ordinary differential equations
- Numerical methods in solving ordinary differential equations of higher order
- Numerical methods in solving partial differential equations
- Introduction of the differential equations and its numerical solutions

Some software (Matlab – Mathematica and others) in solving ordinary and partial differential equations

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**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
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
1.3	Explain notations and concepts required for the solution of Methods of solve differential equations, Partial differential equations, Approximating Eigen values and Least Square Method.	K3
2	**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
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
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
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
3	**Values:**	
3.1	Cultivate a mathematical attitude and nurture the interest.	V1
3.2	Realize the importance of responsibilities through different modes of practice, competition and related activities.	V2
3.3	Inculcating values and ethics in thought, expression and deed.	V3

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	6
2	Numerical Solution of Second and higher order initial value problem	9
3	Least Square Method	9
4	Numerical solution of Partial Differential Equations.	12
5	Approximating Eigenvalues	9
Total		45

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	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.	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.		
1.3	Explain notations and concepts required for the solution of Methods of solve differential equations, Partial differential equations, Approximating Eigen values and Least Square Method.		
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.	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.		
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.		
2.4	Solve mathematical problem using critical thinking for Methods of solve differential equations, Partial differential equations, Approximating Eigen values and Least Square Method.		
3.0	**Values:**		
3.1	Cultivate a mathematical attitude and nurture the interest.	Group work, problem solving, web based work	Assignments
3.2	Realize the importance of responsibilities through different modes of practice, competition and related activities.		
3.3	Inculcating values and ethics in thought, expression and deed.		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homework	3	5%
2	First exam.	7	20%
3	Second exam.	13	20%
4	Homework	14	5%
5	Final exam.	16	50%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : Each group of students assigned to a member of staff who will be available for help and academic guidance office hours at specific hours on daily basis. At least be available 8 hours per week.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Numerical Methods with Applications by Autar Kaw and Egwu Eric Kalu, Publisher: Lulu.com 2008.
Essential References Materials	• 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. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classroom, Computer Lab.
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show; Smart Board, Mathematics software.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (Course Evaluation Survey)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Quality of learning resources	Students, Faculty members	Indirect

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**Board Of Mathematics Department**
Reference No.	**12th Meeting Of The Board Of Mathematics Department 1441-1442**
Date	**14/6/1442 A. H.; 27/1/2021 A. D.**