Course Specification
(Bachelor)

Course Title:	**Mathematical Modeling**
Course Code:	**472MATH-3**
Program:	**Bachelor of Science 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 8 / Year 4

4. Course general Description

This course is designed to provide students with

- The areas of mathematical modeling.
- Date relationship models.
- Principles of mathematical modeling linear and nonlinear.
- Simulation and analytical solution.
- System modeling and its applications.

5. Pre-requirements for this course (if any): 332 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:

- Main concepts of mathematical modeling.
- Transform applications to mathematical problems.
- Use of mathematical software (MATLAB, XPPAUT) for modeling applications.

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	0

3.	Field	0
4.	Tutorial	3
5.	Others (specify)	0
	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 discrete dynamic systems, stability conditions, stochastic and continuous models.	K1	Lectures, Classroom discussions	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
1.2	Identify background, features and structure of mathematical problems in difference equations, modeling with differential equations and probability and statistics modeling concepts.	K2	Lectures, Classroom discussions	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
1.3	Explain simulation of dynamic models, continuous time models, validation of the models, the concept of transition matrix and Markov chain.	K3	Lectures, Classroom discussions	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
2.0	Skills			
2.1	Apply the concept of modeling with difference equations and differential equation in solving real life problems.	S1	Lectures, Classroom discussions	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
2.2	Compute and validate existing mathematical models both linear and nonlinear.	S2	Lectures, Classroom discussions	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
2.3	Apply various mathematical models, techniques and theorems in solving problems in engineering, physical, biological and social sciences.	S3	Lectures, Classroom discussions	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
2.4	Solve mathematical modeling problems such as growth rate problems, logistic equations, prey-	S4	Lectures, Classroom discussions	Written exam (Problem solve, MCQ, true/false, Proof,

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	predator problems using critical thinking.			Short answer), Quizzes, Assignments
3.0	Values, autonomy, and responsibility			
3.1	Cultivate a mathematical attitude and nurture the interest.	V1	Group and interactive discussion	Assignment and discussion
3.2	Realize the importance of responsibilities through different modes of practice, competition, and related activities.	V2	Group and interactive discussion	Assignment and discussion
3.3	Inculcating values and ethics in thought toward the development of study habits essential for independent progress.	V3	Group and interactive discussion	Assignment and discussion

C. Course Content

No	List of Topics	Contact Hours
1.	Discrete dynamic system.	9
2.	Modeling with discrete stochasticity.	9
3.	Structural models and analysis of state diagram.	9
4.	Simulation and analytical solutions, Empirical modeling.	9
5.	Modeling with differential equations and bifurcations.	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	A Course in Mathematical Modeling by Douglas Moody and Randall Swift, Mathematical Association of America, 1999.

Supportive References	Discrete Event System Simulation, Jerry Banks and John S. Carson, Prentice- Hall Inc. 1990.
Electronic Materials	https://www.youtube.com/watch?v=SQZGlJUsKTg
Other Learning Materials	Black board platform

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 student's assessment	Students, Program assessment committee	Direct/ Indirect
Quality of learning resources	Students, Faculty members	Indirect
The extent to which CLOs have been achieved	Instructor	Direct/ Indirect

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.**