هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	**Mathematical Modelling**
Course Code:	2024202-3
Program:	Bachelor in Mathematics.
Department:	Mathematics and Statistics Department
College:	**Faculty of sciences**
Institution:	**Taif university**
Version:	1
Last Revision Date:	20/05/2023

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: 3(3,0,0)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (Level 8 / Fourth year)					
4. Course general Description:					
This course introduces mathematical modelling: Study modelling change with difference equations, approximating change with difference equations, dynamical systems, systems of difference equations, difference operators. Study mathematical models, proportionality, geometric similarity, graphical fitting, analytic fitting, least squares fitting, choosing models, polynomial models, smoothing, cubic splines. Simulation modelling, modelling using graph theory, modelling with differential equation (Population growth, Drug dosage, graphical solutions, numerical approximations, separation of variables, linear equations), some additional applications of mathematics modeling: biological applications, social, chemistry and behavioral sciences applications, physics and engineering applications.					
5. Pre-requirements for this course (if any)**:**					
Linear algebra (2022204-3) & Ordinary Differential Equations (2022201-4)					
6. Co-requirements for this course (if any)**:**					
None					
7. Course Main Objective(s):					
1. Introducing basic notations and concepts about mathematical modelling. 2. Analyzing modeling using geometric similarity, difference equations, differential equations, model fitting and simulation modeling.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**3Hr /Week**	100%

No	Mode of Instruction	Contact Hours	Percentage
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**	45
2.	**Laboratory/Studio**	NA
3.	**Field**	NA
4.	**Tutorial**	NA
5.	**Others (specify)**	NA
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	Recognize the meaning of mathematical model with difference and differential equations.	K2	• Lectures • Group discussions	• Quizzes • Assignments
1.2	Describe modeling, dynamical systems, modelling using geometric similarity, model fitting and simulation modelling.	K2	• Lectures • Group discussions	• Exams • Assignments
2.0	**Skills**			
2.1	Use the model through analytical, graphical solutions or statistical analysis.	S1	• Interactive classes • Group discussions	• Quizzes • Assignments
2.2	Explain standard modelling procedures, which involve	S1	• Lectures • Group discussions	• Exams • Quizzes

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	observations of a natural system and the development of a numeric or analytical model.			
2.3	Apply mathematical descriptions of some real systems.	S1	• Lectures • Self-learning through the website	• Exams • Quizzes • Assignments
3.0	Values, autonomy, and responsibility			
3.1	Work effectively within groups and independently.	V1	• Interactive classes. • Give students tasks of duties.	• Assessment of design projects that have elements of interpersonal skills.
3.2	Articulate ethical behavior associated with institutional Guidelines in classroom, and in Lab.	V3	• Lectures • Group discussions	• Exams • Quizzes

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to mathematical modelling	3
2.	Modelling change with difference equations, Approximating Change with Difference Equations.	3
3.	Dynamical systems, Systems of difference equations, Difference operators	3
4.	Mathematical models, Proportionality.	3
5.	Geometric similarity, Graphical fitting	3
6.	Analytic fitting, least squares fitting.	3
7.	**First Midterm exam**	3
8.	Choosing models & Polynomial models & Smoothing.	3
9.	Cubic splines, Simulation Modelling	3
10	Modelling using Graph Theory.	3
11.	Modeling with a Differential Equation Population growth, Drug dosage.	3
12.	Graphical solutions, Numerical approximations	3
13.	**Second Midterm exam**	3

14.	Separation of variables & Linear equations	3
15.	Some additional applications of Mathematics modeling: Biological applications, Chemical Reaction applications, Social and Behavioral Sciences applications, Physics and Engineering applications.	3
Total		**45**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes	Continuous Evaluation	10%
2.	Assignments, report	Continuous Evaluation	10%
3.	Midterm 1 Exam	8-9	15%
4.	Midterm 1 Exam	12-13	15%
5.	Final Exam	15-16	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	S. Banerjee, Mathematical Modelling (Models, Analysis and Applications), 2015
Supportive References	Bradshow, Noel-Ann, A first course in mathematical modeling, 2012. ISBN 0-53-403367-9
Electronic Materials	1. Journal of Differential Equations (http://www.journals.elsevier.com/journal-of-differential-equations) 2. Applied Mathematical Modeling (https://www.journals.elsevier.com/applied-mathematical-modelling) 3. International Journal of Mathematical Modelling and Numerical Optimization (http://www.inderscience.com/jhome.php?jcode=ijmmno) Mathematical Modelling and Analysis (http://www.tandfonline.com/toc/tmma20/current)
Other Learning Materials	1-Finkelstein, L and Carson E.R. (1985), Mathematical Modelling of Dynamic Biology. 2- Edward A. Bender-An Introduction to Mathematical Modelling-

	John Wiley & Sons Inc (1978). 3-Shum book series in Partial Differential Equations.

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms
Technology equipment (Projector, smart board, software)	Data show, Blackboard
Other equipment (Depending on the nature of the specialty)	None

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Program Leader	Direct & Indirect
Effectiveness of Students assessment	Faculty, Program Leader	Direct
Quality of learning resources	Students, Faculty	Indirect
The extent to which CLOs have been achieved	Faculty	Direct & Indirect
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Department Council
REFERENCE NO.	11
DATE	12-7-1443 H

قسم الرياضيات والإحصاء
Mathematics and Statistics Department
TU جامعة الطائف TAIF UNIVERSITY