جامعة الزيتونة الأردنية

Al-Zaytoonah University of Jordan

Course Syllabus

According to JORDAN National Qualification Framework (JNQF)

Course Name: Mathematical Modelling 2

Course Number: 0101471

General Course Information:

Course Title	**Mathematical Modelling 2**
Course Number	**0101471**
Credit Hours	**3 credit hours**
Education Type	**Blended learning**
Prerequisites/Co-requisites	-
Academic Program	**Bachelor**
Program Code	
Faculty	**Faculty of Science and Information Technology**
Department	**Mathematics**
Level of Course	**3**
Academic Year /Semester	**2023/2024 1st Semester**
Awarded Qualification	**BS'c**
Other Department(s) Involved in Teaching the Course	-
Language of Instruction	**English**
Date of Production	**2021-2022**
Date of Revision	

Course Coordinator:

Coordinator's Name	**Dr. Tareq Hamadneh**
Office No.	**229**
Office Phone Extension Number	
Office Hours	**10-11, 13-14 Sunday, Tuesday** **11-12:30 Monday, Wednesday**
E-mail	**t.hamadneh@zuj.edu.jo**

Other Instructors:

Instructor Name	**NA**
Office No.	
Office Phone Extension Number	
Office Hours	
Email	

Course Description *(English/Arabic)*:

English	This course is an introduction to mathematical modelling using tools from various parts of mathematics to describe and explore real-world data and phenomena. A variety of modelling techniques will be discussed with examples taken from linear programming, Graph theory, Differential and methods of solving matrices, Using of Matlab will take a part of this course. Finally, we study the expansion of polynomials by different methods. Nash equilibrium.
Arabic	تعد هذه الماده مقدمة للنمذجة الرياضية باستخدام أدوات من أجزاء مختلفة في الرياضيات لوصف واستكشاف بيانات وظواهر العالم الحقيقي. ستتم مناقشة مجموعة متنوعة من تقنيات النمذجة مع أمثلة مأخوذة من البرمجة الخطية ونظرية الرسم البياني والتفاضل وطرق حل المصفوفات، وسيكون استخدام Matlab جزءًا من هذه الماده. وأخيرًا، سنقوم بدراسة مفكوك كثيرات الحدود بطرق مختلفة.

Textbook: ***Author(s), Title, Publisher, Edition, Year, Book website.***

A First Course in Mathematical Modeling by F. Giordano, W. Fox and S. Horton, 5th Ed., Cengage, 2013.

References: *Author(s), Title, Publisher, Edition, Year, Book website.*

1. "Concepts of Mathematical Modelling", by J. Meyer, (2004), Dover Publications, ISBN 0-486-4315-6. 2. " Mathematical Modelling", by Stefan Heinz, (2011), Springer, ISBN 978-3-642-20310-7 3. " Principles of Mathematical Modelling, by Clive L. Dym, 2nd Ed., (2004), Elsevier Inc., ISBN: 0-12-226551-3. 4. " Mathematical Modelling", by Mark M. Meerschaert, 4th Ed., (2013), Academic Press (Elsevier Inc.), ISBN: 978-0-12-386912-8.

Course Educational Objectives (CEOs):

CEO1	Provide a mathematical representation of a real-world system or phenomenon, often in the form of equations, to describe how it behaves and changes over time or in different condition
CEO2	Gain insight into the underlying mechanisms and relationships within the system. This may involve exploring cause-and-effect relationships, identifying critical parameters, and understanding the system's behaviour under various conditions.
CEO3	Identify optimal conditions or parameters that maximize or minimize certain objectives. Mathematical models can be used to find the best solutions to complex problems.
CEO4	Develop models that can be applied to similar systems or problems beyond the specific context for which they were initially created.

Intended Learning Outcomes (ILO's):

Intended learning outcomes (ILOs)		Relationship to CEOs	Contribution to PLOs	Bloom Taxonomy Levels*	JNQF Descriptors**
1. K	**Knowledge and Understanding**				
2. 3. ILO1-k	**Solve applications using a variety of problem solving strategies including geometric and algebraic techniques.**	**CEO1**	**PLO1-k**	**Remembering**	**K**
4. 5. ILO2-k	Express mathematical information, concepts, and thoughts in verbal, numeric.	**CEO1**	**PLO2-k**	**Understanding**	**K**
6. 7. ILO3-k	Solve multiple-step problems through different (inductive, deductive, and symbolic) modes of reasoning.	**CEO2**	**PLO3-k**	**Applying**	**K**
S	**Intellectual skills**				
8. 9. ILO4-s	**Modelling using matrices.**	**CEO3**	**PLO7-s**	**Understanding**	**S**
10. 11. ILO5-s	**Modelling using linear programs.**	**CEO3**	**PLO8-s**	**Analyzing**	**S**
12. ILO6-s	**Modelling using graphs and networks.**	**CEO3**	**PLO9-s**	**Applying**	**S**
13. ILO7-s	**Modelling using expansion and least squares**	**CEO3**	**PLO10-s**	**Understanding**	**S**
C	**Subject specific skills**				

14. ILO8-c	Use appropriate technology in the evaluation, analysis, and synthesis of **information in problem solving situations given a set of data from real-world situations.**	**CEO1 - CEO4**	**PLO11-c**	**Applying**	**C**	
D	**Transferable skills:**					
*Bloom Taxonomy Levels:						
Level #	**1**	**2**	**3**	**4**	**5**	**6**
Level Name	**Remembering**	**Understanding**	Applying	Analyzing	**Evaluating**	**Creating**
**** Descriptor (National Qualification Framework Descriptors): K: Knowledge, S: Skill, C: Competency.**						

Program Learning Outcome (PLOs):

	(PLOs)	JNQF Descriptors**		
		K	S	C
1.	Knowledge of the main concepts in pure mathematics.	√		
2.	Knowledge of the main concepts in applied mathematics.	√		
3.	Explain concepts, principles and theories in the fields of probability and statistics.	√		
4.	Possession of technological culture related to the fields of mathematics and its applications.	√		
5.	Making use of mathematical logic in practical life.		√	
6.	Engaging scientific methodology as a way of thinking and as a tool in facing problems.		√	
7.	Applying mathematical software packages in problem solving.		√	
8.	Being capable of data analysis.		√	
9.	Capability of teaching according to modern educational techniques.		√	
10.	Develop creative and innovative methods of teaching mathematics.		√	
11.	Showing the ability to work under ethical and professional standards within teams.			√
12.	Gaining critical thinking and scientific research skills.			√

**** Descriptors according to the national qualifications framework (K: knowledge, S: skill, C: Competency)**

Weekly Schedule *(please choose the type of teaching)*

- ☐ Face to Face (F2F)
- ☒ **Hybrid** *(One – To - One)*
- ☐ Online

Schedule of Simultaneous and their Topics:

Week	First Lecture (F2F)	Second Lecture	ILOs	PLOs	JNQF Descriptors*
1	What is Mathematical Modelling? Steps of the Modeling Process.	Activity of studying Background	ILO1-k	PLO1-k	Understanding

2	Plotting data, proportionality. Fitting linear data visually.	Video 1 Solving exercises	ILO2-k	PLO2-k	Evaluating
3	Introduction to optimization.	Home work1: On the basics	ILO2-k	PLO2-k	Understanding
4	Modelling exponential data. Modelling exponential data.	Quiz 1	ILO3-k	PLO3-k	Understanding
5	Method of least squares.	Assignment 1: On Linear programming	ILO4-s	PLO5-s	Creating
6	Review of vectors and matrices. Transition matrix. Modelling using Leslie matrices	Video 2	ILO5-s	PLO6-s	Remembering
7	Optimization using calculus.	Home work 2 On the subjects studied in weeks 4,5 and 6	ILO5-s	PLO7-s	Applying
Midterm Exam					
9	The theory of linear programming.	Assignment 2: On Matrices	ILO6-s	PLO8-s	Analyzing
10	Duality in linear programming.	Self-reading	ILO7-s	PLO9-s	Applying
11	Integer programming. Branch and bound method.	Video3 Solving exercises	ILO7-s	PLO10-s	Analyzing
12	Modeling with graphs.	Home work 3: On the subjects studied after the Mid-Exam	ILO8-c	PLO11-c	Analyzing
13	Minimum spanning tree. Maximum-flow problems.	Self-reading	ILO8-c	PLO11-c	Applying
14	Euler's method. Bezier method.	Quiz 2	ILO8-c	PLO12-c	Analyzing
15	**Projects Discussion**				
16	**Final Exam**				

* **K: Knowledge, S: Skills, C: Competency**

Teaching Methods and Assignments:

Development of ILOs is promoted through the following teaching and learning methods:

- **Lecture and Lab.**
- **Zoom and Videos**
- **learning through projects.**
- **learning through problem solving.**

Course Policies:

A- Attendance policies:
The maximum allowed absences is 15% of the lectures.
B- Absences from exams and handing in assignments on time:
Midterm exam can be retaken based on approval of excuse by the instructor's discretion.
Not handing assignment on time will incur penalties.
C- Academic Health and safety procedures
D- Honesty policy regarding cheating, plagiarism, and misbehaviour:
Cheating, plagiarism, misbehaviour will result in zero grade and further disciplinary actions may be taken.
E- Grading policy:

- All homework is to be posted online through the e-learning system.
- Exams will be marked within 72 hours and the marked exam papers will be handed to the students.
- Online Activities (Course Videos, Practice labs, Discussion Forums, Quizzes) **20%**
- Midterm 30**%**
- Final Exam 50**%**

F- Available university services that support achievement in the course: **E-Learning Platform, Labs, Library.**

Required Equipment:

- PC / Laptop with webcam and mic
- Internet Connection
- Access to the ZUJ E-Learning Platform at https://exams.zuj.edu.jo/
- E-learning plan
- Satisfaction questionnaires for online and face-to-face learning.

Assessment Tools Implemented in the Course:

- Final Exam
- Midterm Exam
- Quizzes
- Homework
- Discussion Forums
- Improvement plans for online or face-to-face teaching.

Responsible Persons and their Signatures:

Course Coordinator	Dr. Tareq Hamadneh	**Completed Date**	**17/ 10/2023**
		Signature	

Received by (Department Head)		**Received Date**	/ /
		Signature	