Philadelphia University	PHILADELPHIA UNIVERSITY THE WAY TO THE FUTURE	**Approval date: 20/02/2025**
Faculty of Science		**Issue:**
Department of Math		**Credit hours: 3**
Academic year 2024/2025	**Course Syllabus**	**Bachelor**

Course information

Course#	Course title	Prerequisite
250471	**Mathematical Modeling**	**ODEs 250203**

Course type	Class time	Room #
☐ University Requirement ☐ Faculty Requirement ☒ Major Requirement ☐ Elective ☒ Compulsory	Sat. Mon. Wed. 11:30 – 12:30	2827
Degree / NQF Level ☐ Diploma degree (6) ☒ Bachelor degree (7)		

Instructor Information

Name	Office No.	Phone No.	Office Hours	E-mail
Feras Awad	822	2132	Sun. Tue. 11:30 – 12:30	fawad@philadelphia.edu.jo

Course Delivery Method

Course Delivery Method			
☐ **Physical** ☐ **Online** ☒ **Blended**			
Learning Model			
Precentage	**Synchronous**	**Asynchronous**	**Physical**
	0%	**33%**	**67%**

Course Description

This course offers a practical introduction to mathematical modeling of real-world phenomena. Students learn to build, analyze, and interpret models using difference and differential equations, data fitting, and applications in areas like population growth, cooling, and motion.

Course Learning Outcomes

Number	Outcomes	Corresponding Program outcomes
	Knowledge	
K1	Define key concepts in mathematical modeling, including models, modeling assumptions, and the modeling cycle.	**K_p1**
K2	Describe the structure and applications of different types of models, such as difference equations, differential equations, and nonlinear models.	**K_p3**
	Skills	
S1	Construct mathematical models to represent and analyze real-world problems across various disciplines.	**S_p3**
	Competencies	
C1	Work in a team to implement one of the tasks of the course.	**C_p2**

Learning Resources

Course textbooks	**[1]** Giordano, Fox, Horton (2014) A First Course in Mathematical Modeling (5th ed.). Brooks / Cole Cengage Learning. **[2]** Zill and Wright (2014) Advanced Engineering Mathematics (5th ed.). Jones & Bartlett Learning.
Supporting References	• Clive Dym (2004) Principles of Mathematical Modeling (2nd ed.). Elsevier Academic Press. • Brian Albright, William Fox (2020) Mathematical Modeling with Excel (2nd ed.). Taylor & Francis Group.
Supporting websites	GeoGebra: www.geogebra.org
Teaching Environment	☒**Classroom** ☐ **laboratory** ☒**Learning platform** ☐**Other**

Meetings and Subjects Timetable

Week	Topic	Learning Methods	Tasks	Learning Material
1	Explanation of the study plan for the course, and what is expected to be accomplished by the students. **What is Mathematical Modeling?** What is modeling? Mathematical Model: What, Why, and How? Applications. Objectives. Modeling Cycle. Principles.	Lecture		Course Syllabus
2	**Modeling Change:** Modeling Change with Difference Equations Solutions to Dynamical Systems	Lecture		Book 1 (1.1) Book 1 (1.3)
3	**Model Fitting:** Fitting Models to Data Graphically Applying the Least-Squares Criterion	Lecture	Quiz	Book 1 (3.1) Book 1 (3.3)
4	**Review of 1st Order ODEs:** ODE. Solution of a DE. IVPs. Separable ODEs. **Differential Equations as Mathematical Models:** What is Mathematical modeling? Some examples.	Lecture		Book 2 (2.2) Book 2 (1.3)
5	**Linear Models:** Growth and Decay, Half-Life, Carbon Dating. Newton's Law of Cooling/Warming, Mixtures, Series Circuits, Free Falling.	Lecture	Midterm	Book 2 (2.7)
6	**Nonlinear Models:** Population Dynamics, Logistic Equation, Chemical Reactions.	Lecture		Book 2 (2.8)
7	**Review of 2nd Order Homogeneous ODEs with Constant Coefficients.** **Higher Order Linear Models IVPs:** Spring/Mass Systems: Free Undamped Motion, Spring/Mass Systems: Free Damped Motion	Lecture	Quiz	Book 2 (3.3) Book 2 (3.3)
8	**Final Exam**			

* Includes: Lecture, flipped Class, project- based learning, problem solving based learning, collaborative learning

Course Contributing to Learner Skill Development

Using Technology
• Use GeoGebra to simulate a mathematical model.
Communication Skills
• Choose a mathematical model and present it to the students and explain its solution method.
Application of Concepts Learnt
• Choose a math model from real-life and try to re-formulate and solve it.

Assessment Methods and Grade Distribution

Assessment Methods	Grade Weight	Assessment Time (Week No.)	Link to Course Outcomes
Mid Term Exam	**30%**	**5**	**K1, K2**
Various Assessments *	**30%**	**Continuous**	**S1, C1**
Final Exam	**40%**	**8**	**K1, K2**
Total	**100%**		

* Includes: quiz, in class and out of class assignment, presentations, reports, videotaped assignment, group or individual projects.

Alignment of Course Outcomes with Learning and Assessment Methods

Number	Learning Outcomes	Learning Method*	Assessment Method**
	Knowledge		
K1	Define key concepts in mathematical modeling, including models, modeling assumptions, and the modeling cycle.	Lecture	**Exam**
K2	Describe the structure and applications of different types of models, such as difference equations, differential equations, and nonlinear models.	Lecture	**Exam**
	Skills		
S1	Construct mathematical models to represent and analyze real-world problems across various disciplines.	Lecture	**Homework**
	Competencies		
C1	Work in a team to implement one of the tasks of the course.	Project	**Group Project**

* Includes: Lecture, flipped Class, project- based learning, problem solving based learning, collaborative learning

** Includes: quiz, in class and out of class assignment, presentations, reports, videotaped assignment, group or individual projects.

Course Polices

Policy	Policy Requirements
Passing Grade	The minimum passing grade for the course is (50%) and the minimum final mark recorded on transcript is (35%).
Missing Exams	• Missing an exam without a valid excuse will result in a zero grade to be assigned to the exam or assessment. • A Student who misses an exam or scheduled assessment, for a legitimate reason, must submit an official written excuse within a week from an exam or assessment due date. • A student who has an excuse for missing a final exam should submit the excuse to the dean within three days of the missed exam date.

Attendance	The student is not allowed to be absent more than (15%) of the total hours prescribed for the course, which equates to six lectures days (M, W) and six lectures (S, T). If the student misses more than (15%) of the total hours prescribed for the course without a satisfactory excuse accepted by the dean of the faculty, s/he will be prohibited from taking the final exam and the grade in that course is considered (zero), but if the absence is due to illness or a compulsive excuse accepted by the dean of the college, then withdrawal grade will be recorded.
Academic Honesty	Philadelphia University pays special attention to the issue of academic integrity, and the penalties stipulated in the university's instructions are applied to those who are proven to have committed an act that violates academic integrity, such as: cheating, plagiarism (academic theft), collusion, and violating intellectual property rights.

Program Learning Outcomes to be Assessed in this Course

Number	Learning Outcome	Course Title	Assessment Method	Target Performance level
S_p3	The ability to translate real-life problems into mathematical models.	Mathematical Modeling	Homework	All students get 70% or more on the rubric

Description of Program Learning Outcome Assessment Method

Number	Detailed Description of Assessment
S_p3	The student will be given a model and will be required to express it using appropriate mathematical equations and relationships, clearly identifying the variables and their interdependencies.

Assessment Rubric of the Program Learning Outcome

	Poor (1 pt.)	**Fair** (2 pts)	**Good** (3 pts)
Understanding of the Topic	Shows little or no understanding; concepts are confused or incorrect.	Demonstrates basic understanding with minor misconceptions.	Shows clear and thorough understanding of the topic.
Application of the Concept	Unable to apply the concept or determine when it is relevant.	Can apply the concept in familiar contexts with some guidance.	Applies the concept accurately and confidently in both familiar and new contexts.
Clarity of Reasoning	Reasoning is unclear or illogical; difficult to follow.	Reasoning is generally clear but may lack depth or consistency.	Reasoning is clear, logical, and well-supported with appropriate explanations or justifications.