Philadelphia University	PHILADELPHIA UNIVERSITY THE WAY TO THE FUTURE	Approval date: 28/2/2026
Faculty of Science		Issue:
Department of Math		Credit hours: 3
Academic year 2025/2026	Course Syllabus	Bachelor

Course information

Course#	Course title	Prerequisite
250371	Numerical Analysis	ODE 250203

Course type		Class time	Room #
☐ University Requirement ☐ Faculty Requirement ☒ Major Requirement ☐ Elective ☒ Compulsory		1 SM 14:15-13:30	21003
Degree / NQF Level	☐ Diploma degree (6) ☒ Bachelor degree (7)		

Instructor Information

Name	Office No.	Phone No.	Office Hours	E-mail
Feras Awad	822	2132	SM 12:45 – 13:45 ST 11:15 – 12:15	fawad@philadelphia.edu.jo

Course Delivery Method

Course Delivery Method		
☒ Physical	☐ Online	☐ Blended
Learning Model		
Precentage	Synchronous	Asynchronous	Physical
	0%	0%	100%

Course Description

Numerical Analysis introduces fundamental computational methods including error analysis, root finding, interpolation, numerical differentiation and integration, and solving linear systems. The course emphasizes accuracy, stability, efficiency, and practical implementation using computational tools.

Course Learning Outcomes

Number	Outcomes	Corresponding Program outcomes *
Knowledge		
K1	Explain the fundamental concepts of error analysis, including round-off errors and Taylor series approximations.	K_p1
K2	Describe numerical methods for solving nonlinear equations, including bisection, fixed-point iteration, and Newton's method.	K_p1
K3	Understand the principles of interpolation, numerical differentiation, and numerical integration.	K_p1
Skills		
S1	Apply and implement numerical algorithms to approximate solutions of equations, integrals, ODEs, and linear systems by using computational tools or programming languages.	S_p4

Competencies		
C1	Collaborate effectively in teams to solve numerical problems, analyze errors, and present findings clearly and concisely.	**C$_p$2**

Learning Resources

Course textbook	Richard L. Johnson and Douglas J. Faires. (2011) Numerical Analysis. (9th ed.). Brooks / Cole.
Supporting References	• Ward Cheney and David Kincaid. (2004) Numerical mathematics and computing. (5th ed.). Brooks / Cole. • John H. Mathews and Kurtis D. Fink. (2004) Numerical methods using MATLAB. (4th ed.). Prentice Hall.
Supporting websites	• Companion Website: https://sites.google.com/site/numericalanalysis1burden/ • Geogebra: https://www.geogebra.org/ • Online Python Compiler: https://replit.com/new/python3
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. **Mathematical Preliminaries & Error Analysis** 1.1 Review of Calculus (Taylor Polynomial)	Lecture		Course Syllabus Chapter 1
2	1.2 Round-off Errors and Computer Arithmetic **Solutions of Equations in One Variable** 2.1 The Bisection Method	Lecture		Chapter 1 Chapter 2
3	2.2 Fixed-Point Iteration	Lecture		Chapter 2
4	**Blessed Eid al-Fitr holiday**			
5	2.2 Fixed-Point Iteration (*cont.*)	Lecture		Chapter 2
6	2.3 Newton's Method and Its Extensions	Lecture	Quiz 1	Chapter 2
7	**Interpolation and Polynomial Approximation** 3.1 Interpolation and the Lagrange Polynomial	Lecture		Chapter 3
8	3.3 Divided Differences	Lecture	Midterm	Chapter 3
9	**Numerical Differentiation and Integration** 4.1 Numerical Differentiation	Lecture		Chapter 4
10	4.3 Elements of Numerical Integration	Lecture		Chapter 4
11	4.4 Composite Numerical Integration	Lecture	Quiz 2	Chapter 4
12	4.4 Composite Numerical Integration (*cont.*)	Lecture		Chapter 4
13	**Iterative Techniques in Matrix Algebra** 7.1 Norms of Vectors and Matrices	Lecture		Chapter 7
14	7.3 The Jacobi and Gauss-Siedel Iterative Techniques	Lecture	Quiz 3	Chapter 7
15	**Blessed Eid al-Adha holiday**			
16	Final Exam			

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

Self-Review Exercises and Problem-solving from the Textbook

Chapter	Section	Exercises
1	1	8, 9, 19
	2	1(c, d, g), 2(a, b, c, d), 5(e, f), 19(a)
2	1	1, 2, 5(b), 6(c), 11, 13, 16, 18
	2	1(a, d), 2(a, b), 5, 8, 9, 16, 17
	3	1, 2, 4a
3	1	1(a, b), 6(a), 8(a), 9, 13(a)
	3	4(a, b), 7(a, b), 9(a), 10, 13, 17
4	1	2(a), 4(a), 18(a)
	3	1(a), 3(a), 5(a), 7(a), 9(a), 11(a), 13, 14, 15, 17, 18, 19.
	4	1, 3, 5, 7, 9, 10, 13
5	1	1, 2, 3, 5, 9
	2	1, 2, 3, 9
	4	1, 2, 6, 10, 14, 30, 31
7	1	1, 3, 5, 7, 9
	3	1, 3, 5, 7, 9

Course Contributing to Learner Skill Development

Using Technology
• Utilize interactive simulations and visualization tools (e.g. Geogebra) to help students develop a deeper understanding of numerical concepts and algorithms.
• Integrate the use of computational tools and software such as Excel, Python with NumPy and SciPy libraries, or Mathematica to implement numerical algorithms and solve mathematical problems.
Communication Skills
• Encourage students to engage in peer discussions, group work, and online forums to exchange ideas, collaborate, and articulate mathematical solutions effectively.
Application of Concepts Learnt
• Assign problem-solving projects that require students to apply numerical methods concepts to novel problems and situations, helping them develop problem-solving and critical thinking skills.

Assessment Methods and Grade Distribution

Assessment Methods	Grade Weight	Assessment Time (Week No.)	Link to Course Outcomes
Mid Term Exam	**30%**	**8**	**K1, K2**
Various Assessments *	**30%**	**Continuous**	**K1, K2, K3, S1**
Final Exam	**40%**	**16**	**K1, K2, K3**
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 Methods*	Assessment Method
Knowledge			
K1	Explain the fundamental concepts of error analysis, including round-off errors and Taylor series approximations.	Lecture	**Exam**
K2	Describe numerical methods for solving nonlinear equations, including bisection, fixed-point iteration, and Newton's method.		
K3	Understand the principles of interpolation, numerical differentiation, and numerical integration.		
Skills			
S1	Apply and implement numerical algorithms to approximate solutions of equations, integrals, ODEs, and linear systems by using computational tools or programming languages.	Self-learning	**Computer project**
Competencies			
C1	Collaborate effectively in teams to solve numerical problems, analyze errors, and present findings clearly and concisely.	Case study	**Homework**

* 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 seven lectures (S, T, 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$_p$2	The ability to apply mathematics in various real-life situations.	Numerical Analysis	Quiz	100% of the students get 80% or more on the rubric

Description of Program Learning Outcome Assessment Method

Number	Detailed Description of Assessment
S$_p$2	Students will select a real-life problem or scenario that requires numerical analysis for its solution. Then they will apply numerical methods and techniques learned in the course to solve the formulated mathematical model.

Assessment Rubric of the Program Learning Outcome

	Excellent (4 pts) — Student understands the concept perfectly.	**Good** (3 pts) — Student is almost perfect in their understanding of the topic, with some minor confusion or mistakes.	**Fair** (2 pts) — Student has a decent grasp of the process but makes some major mistakes.	**Poor** (1 pt.) — Student is very confused and does not understand the topic, nor is able to clearly grasp how to apply it or when to use it.
Problem Identification and Relevance	The problem is clearly identified with significant real-world relevance. The chosen problem demonstrates a deep understanding of its context and importance.	The problem is adequately identified with some real-world relevance. The chosen problem demonstrates a good understanding of its context and importance.	The problem identification lacks clarity or relevance to real-world situations. The chosen problem demonstrates a limited understanding of its context and importance.	The problem identification is unclear or irrelevant to real-world situations.
Mathematical Modeling	The mathematical model is sophisticated, accurately representing the real-life problem with appropriate equations and assumptions. The model demonstrates a deep understanding of the underlying mathematics.	The mathematical model is accurate, representing the real-life problem with appropriate equations and assumptions. The model demonstrates a good understanding of the underlying mathematics.	The mathematical model is somewhat accurate but lacks precision in representing the real-life problem. The model demonstrates a limited understanding of the underlying mathematics.	The mathematical model is inaccurate or incomplete in representing the real-life problem.
Numerical Analysis Techniques	A variety of advanced numerical techniques are correctly applied, demonstrating a deep understanding of their theoretical foundations and practical implementation.	Basic and intermediate numerical techniques are correctly applied, demonstrating a good understanding of their theoretical foundations and practical implementation.	Numerical techniques are attempted but with some errors or inaccuracies, indicating a limited understanding of their theoretical foundations and practical implementation.	Numerical techniques are not applied or are applied incorrectly.
Analysis and Interpretation	Results are thoroughly analyzed and interpreted with insightful conclusions drawn from the numerical solutions. The analysis demonstrates a deep understanding of the implications of the results.	Results are adequately analyzed and interpreted with logical conclusions drawn from the numerical solutions. The analysis demonstrates a good understanding of the implications of the results.	Results are analyzed but with limited depth or clarity in interpretation. The analysis demonstrates a basic understanding of the implications of the results.	Not Evident: Results are not analyzed or interpreted.