

COURSE DESCRIPTIONS

Faculty	Science and Information Technology				
Department	Mathematics			NQF level	8
Course Title	Numerical Analysis	Code	505721	Prerequisite	-
Credit Hours	3	Theory	3	Practical	-
Course Leader	Dr. Belal Batiha	email	b.bateha@jadara.edu.jo		
Lecturers	Dr. Belal Batiha	emails	b.bateha@jadara.edu.jo		
Lecture time	15:00-18:00	Classroom	Online		
Semester	First Semester, 2023	Production		Updated	2023
Awards	-			Attendance	

Short Description

This course includes the study of Numerical Differentiation and Integration. Solving the Initial-Value Problems for Ordinary Differential Equations by several mathematical numerical techniques. Solving Boundary-Value Problems for Ordinary Differential Equations using several mathematical numerical techniques such as Linear Shooting Method and Finite-Difference Methods. finding a Numerical Solutions to Partial Differential Equations

Course Objectives

- Approximate differentiation & integration.
- Solve IVP of ordinary differential equations numerically.
- Solve Boundary-Value Problems for Ordinary Differential Equations.
- Numerical Solutions to Partial Differential Equations.

Learning Outcomes

A. Knowledge - Theoretical Understanding

- Apply appropriate theories, principles and concepts relevant to the numerical analysis.
- Formulate a reasoned argument from a variety of sources relevant to Numerical Analysis.

B. Knowledge - Practical Application

- Analyze and interpret information from a variety of sources relevant to Numerical Analysis.
- Select a reasoned argument to the solution of familiar and unfamiliar problems relevant to Numerical Analysis.

C. Skills - Generic Problem Solving and Analytical Skills

- Plan practical activities using techniques and procedures appropriate to Numerical Analysis

D. Skills - Communication, ICT, and Numeracy

- Evaluate numerically the IVP and BVP for ODE and PDE.


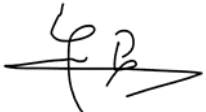
E. Competence: Autonomy, Responsibility, and Context

Teaching and Learning Methods
<ul style="list-style-type: none"> • E-learning. • Distance learning using (Microsoft Teams). • Problem based learning (PBL), • Direct students to self-learning through textbooks, library, e-library, and research papers. • Tutorials, and discussion.
Assessment Methods
Assignments, Exams, Quizzes, Discussion and Interaction

Course Contents					
W	Hours	CLOs	Topics	Teaching & Learning Methods	Assessment Methods
1.	3	a1	Numerical Differentiation and Richardson's Extrapolation	Lecturing, examples, Discussion.	Discussion and Interaction
2.	3	a1,b1	Elements of Numerical Integration and Composite Numerical Integration	Lecturing, examples, Discussion.	Discussion and Interaction
3.	3	a1,b1	The Elementary Theory of Initial-Value Problems and Euler's Method	Lecturing, examples Discussion.	Participation
4.	3	a2,b2	Higher-Order Taylor Methods and Runge-Kutta Methods	Lecturing, examples Discussion.	Participation
5.	3		Multistep Methods and Extrapolation Methods	Lecturing, examples Discussion.	Discussion and Interaction
6.	3	a2, b1, b2		Lecturing, examples Discussion.	Discussion and Interaction
7.	3	a1, a2, b1, a2, b2b2	Stability.	Lecturing, oral discussion	Participation
8.	3	a2,b1, b2	The Linear Shooting Method for linear and nonlinear problems	Lecturing, oral discussion	Participation
9.	3	b2	Finite-Difference Methods for linear problems	Lecturing, examples	Discussion and Interaction
10.	3	a2, b2	Finite-Difference Methods for nonlinear problem	Lecturing, examples	Discussion and Interaction
11.	3	a2, b2	The Rayleigh-Ritz Method	Lecturing, examples	Discussion and Interaction
12.	3	a3, b3	Numerical solutions for Elliptic Partial Differential Equations	Lecturing, oral discussion	Discussion and Interaction
13.	3	a3,b1, b3	Numerical solutions for Parabolic Partial Differential Equations	Lecturing, oral discussion	Discussion and Interaction
14.	3	a3,b1, b3	Numerical solutions for Hyperbolic Partial Differential Equations	Lecturing, examples	Cooperative learning
15.	3	a3,a1,b1, b3	An Introduction to the Finite-Element Method	Lecturing, examples	Cooperative learning
16.			Final Exam		Exam

Infrastructure	
Textbook	Numerical Analysis by Richard L. Burden and J. Douglas Faires, 9 th Edition, Thomson Brooks/Cole, 2010.
References	Numerical methods for engineers, Steven C. Chapra and Rymond P. Canale, 7 th Edition, Mc Graw Hill Education, 2015
Required reading	
Electronic materials	Jadara University E-Learning System
Other	

Course Assessment Plan								
Assessment Method	Grade	CLOs						
		a1	a2	a3	b1	b2	b3	
Midterm Exam	15%	3	3	3	3	3	0	
Final Exam	25%	5	4	4	4	4	4	
Coursework	60%							
Coursework assessment methods	Assignments	20%	4	4	3	3	3	3
	Discussion and interaction	10%	2	2	2	2	1	1
	Report + Presentations	30%	5	5	5	5	5	5
Total	100%							

	د. بلال بطيحة	منسق المادة
	د. طارق قواسمه	رئيس قسم الرياضيات

Plagiarism
<p>Plagiarism is claiming that someone else's work is your own. The department has a strict policy regarding plagiarism and, if plagiarism is indeed discovered, this policy will be applied. Note that punishments apply also to anyone assisting another to commit plagiarism (for example by knowingly allowing someone to copy your code).</p> <p>Plagiarism is different from group work in which a number of individuals share ideas on how to carry out the coursework. You are strongly encouraged to work in small groups, and you will certainly not be penalized for doing so. This means that you may work together on the program. What is important is that you have a full understanding of all aspects of the completed program. In order to allow proper assessment that this is indeed the case, you must adhere strictly to the course work requirements as outlined above and detailed in the coursework problem description. These requirements are in place to encourage individual understanding, facilitate individual assessment, and deter plagiarism.</p>