Jordan University of Science and Technology

Faculty of Science & Arts

Mathematics Department

MATH721 Numerical Analysis (1)

First Semester 2023-2024

Course Catalog
3 Credit Hours. 3 Credit Hours. This course is designed for graduate students in Mathematics. Students have taken a first course in Numerical analysis can register for the course and get benefit of its topics. In this course, we discuss in details Interpolation Theory, Approximation Theory, Numerical Integration, Numerical Methods for ODE's: (IVP), Numerical Methods for BVP, Matrix Eigenvalue Problem, and Introduction to Numerical Solutions of PDE's.

Text Book	
Title	Numerical Analysis
Author(s)	R. L. Burden and J. D. Faires
Edition	9th Edition
Short Name	Text Book
Other Information	

Course References

Short name	Book name	Author(s)	Edition	Other Information
Ref1	Numerical Methods	Germund Dahlquist and ?ke Bj?rck	1st Edition	
Ref2	Numerical Analysis	Lee Johnson and R. Dean Riess	2nd Edition	
Ref4	Numerical Methods	G. Dahlquist, A. Bjorck, and Anderson	1st Edition	
Ref5	Introduction to Numerical Analysis	J. Stoer and R. Bulirsch (2010)	1st Edition	
Ref6	Introduction to Numerical Analysis	J. Gregory and D. Redmond	1st Edition	

Instructor

Name	**Prof. Mohammad Al-Towaiq**
Office Location	Ph L0
Office Hours	
Email	towaiq@just.edu.jo

Class Schedule & Room
Section 1: Lecture Time: Sun, Tue : 15:30 - 16:30 Room: NG41

Tentative List of Topics Covered		
Weeks	**Topic**	**References**
Weeks 1, 2	Interpolation Theory: Polynomial Interpolation Theory; Newton Divided Differences; Finite Differences and Table-Oriented Interpolation Formulas; Errors in Data and Forward Differences; Hermite Interpolation; Spline interpolation.	**Chapter 3** From **Text Book**
Weeks 3, 4, 5	Approximation Theory: Review of discrete Least Squares Approximation; Orthogonal Polynomials and Least Squares, Chebyshev, Polynomials; Rational Functions, and Trigonometric Polynomial Approximations.	**Chapter 8** From **Text Book**
Weeks 6, 7	Numerical Integration: Review of Newton's Cotes Formulas; Romberg Integration; Adaptive Quadrature Methods; Multiple Integrals; Improper Integrals.	**Chapter 4** From **Text Book**
Weeks 8, 9, 10, 11	Numerical Methods for ODE's: (IVP): Review of Taylor Series Methods and Runge-Kutta Methods; Adaptive Runge-Kutta Methods; Multi-Steps Methods; Higher-Order Equations and Systems of Differential Equations; Stability. Numerical Methods for BVP: The Shooting Method; Finite-Difference Methods; The Rayleigh-Ritz Method.	**Chapter 5 +11** From **Text Book**
Weeks 12, 13	The Matrix Eigenvalue Problem: Review of Linear Algebra and Eigenvalues, Gerschgorin Theorem, and The Power Method; the QR Algorithm, and the LR algorithm.	**Chapter 9** From **Text Book**
Weeks 14, 15	Introduction to Numerical Solutions of PDE's: Elliptic PDE; Parabolic PDE; Hyperbolic PDE; An Introduction to Finite-Eliminate Method.	**Chapter 12** From **Text Book**

Mapping of Course Outcomes to Program Outcomes	**Course Outcome Weight (Out of 100%)**	**Assessment method**
To present most of the available numerical methods for solving problems with concentration on a sufficient number of methods to handle the problems likely to be encountered in practice. [25SLO1]	25%	
To introduce students to the potentialities of modern computer for solving problems in science and technology. [10SLO2]	10%	

To present a wide diversity of topics so that the student can see at once the immense range of applications for the subject. [15SLO1]	15%	
To apply well-known numerical techniques to solve engineering problems and evaluate the results. [10SLO1, 5SLO2]	15%	
To train students to understand why the methods work, what type of errors to expect, and when an application might lead to difficulties. [20SLO3]	20%	
Apply and interpret the results of numerical methods when employed to solve problems from selected application areas of numerical analysis. [3SLO1, 3SLO4, 9SLO6]	15%	

Relationship to Program Student Outcomes (Out of 100%)					
SLO1	SLO2	SLO3	SLO4	SLO5	SLO6
53	15	20	3		9

Evaluation	
Assessment Tool	**Weight**
Midterm Exam	25%
Projects	15%
Final exam	50%
Quizzes	10%

Policy	
Exams	1. The format for the exams is generally (but NOT always) as follows: Computation, analysis, and design. 2. Grades will not be given out via e-mail. 3. The final exam covers all the material in the course.
Quizzes	Quizzes (10-15 minutes) will be given at the end of the lecture. Typically they will involve some questions that are designed to test the understanding of the material discussed in the preceding lectures.
Makeup Exams	1. Let the instructor know about your makeup exam before 3 days prior to the scheduled exam time. 2. Makeup exam should not be given unless there is a valid excuse.
Drop Date	Last day to drop the course is according to the university calender
Cheating	1. Cheating or copying from neighbor on exam, or quiz is an illegal and unethical activity. 2. Standard JUST policy will be applied.
Attendance	1. Excellent attendance is expected. 2. JUST policy requires the faculty member to assign ZERO grade (35) if a student misses 20% of the classes. 3. Sign-in sheets will be circulated. 4. If you miss class, it is your responsibility to find out about any announcements or assignments you may have missed.
Workload	Average work-load student should expect to spend is 6 hours/week.

Graded Exams	Instructor should return exam, quiz, Hw's, and project papers graded to students during the week after the due date.
Participation	Participation in, and contribution to class discussions will affect your final grade positively. Raise your hand if you have any question.

Date Printed: 2023-10-08