Course Description Form

1. Course Name:
Numerical Analysis
2. Course Code:
3. Semester / Year:
First Semester/Second Year
4. Description Preparation Date:
2024-4-3
5. Available Attendance Forms:
Classroom or by Web
6. Number of Credit Hours (Total) / Number of Units (Total)
60 Hours
7. Course administrator's name (mention all, if more than one name)
Name: Dhabiaa Mahmood Ali Email: Dhabiaa.m.ali@tu.edu.iq Name:Humam Neamah Hussein Email: Humam.n.hussein@tu.edu.iq
8. Course Objectives
1. Explain the importance of numerical analysis and explain how to use it in solving practical problems with non-analytical solutions. 2. Explain the numerical methods used to solve nonlinear equations. 3. Analyze the errors related to these methods and discuss the convergence rates. 4. Estimate errors and discuss the convergence of iterative methods. 5. Explain numerical methods for calculus, with an emphasis on accuracy and error estimation. 6. Solve ordinary differential equations using numerical methods, while studying the convergence and stability of these methods.
9. Teaching and Learning Strategies
1. Explain the importance of numerical analysis and explain how to use it in solving practical problems with non-analytical solutions. 2. Explain the numerical methods used to solve nonlinear equations. 3. Analyze the errors related to these methods and discuss the convergence rates. 4. Estimate errors and discuss the convergence of iterative methods. 5. Explain numerical methods for calculus, with an emphasis on accuracy and error estimation.

6. Solve ordinary differential equations using numerical methods, while studying the convergence and stability of these methods.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Types of errors in the approximate solution	Error and its sources (relative error, absolute error)	Theoretical Lecture and discussion	Oral tests and quizzes
2	4	Identify errors in calculations	Errors in calculations (addition, subtraction, multiplication and division) and solving examples	Theoretical Lecture and discussion	Oral tests and quizzes
3	4	Determine root locations	Determine the root of the equation and determine the locations of the roots by solving examples	Theoretical Lecture and discussion	Oral tests and quizzes
4	4	The Bisection method	Numerical methods for solving nonlinear equations, bisection method, example solution, and writing algorithm	Theoretical Lecture and discussion	Oral tests and quizzes
5	4	False position method	Derived from the approximate root of the false localization method with solving examples and writing the algorithm	Theoretical Lecture and discussion	Oral tests and quizzes
6	4	Secant method	Derived from the approximate root of the Secant method with example solution and algorithmic writing	Theoretical Lecture and discussion	Oral tests and quizzes
7	4	Newton-Raphson method	Derived from the approximate root of the Newton-Raphson method, solving examples and writing the algorithm	Theoretical Lecture and discussion	Oral tests and quizzes
8	4	Newton-Raphson method	Special cases of the Newton-Raphson method and solving examples	Theoretical Lecture and discussion	1st Midterm exam in previous weeks(1-7)
9	4	Direct methods: Gauss elimination method	Numerical solutions of systems of linear equations	Theoretical Lecture and discussion	Oral tests and quizzes
10	4	Matrix partitioning methods projection	Numerical solutions of systems of linear equations	Theoretical Lecture and discussion	Oral tests and quizzes
11	4	Iterative methods	Jacobi method	Theoretical Lecture and discussion	Oral tests and quizzes
12	4	Iterative methods	Gauss-Seidel method	Theoretical Lecture and discussion	Oral tests and quizzes
13	4	Iterative methods	Successive satisfaction method	Theoretical Lecture and discussion	Oral tests and quizzes
14	4	Internal modification methods	Lagrange method	Theoretical Lecture and discussion	Oral tests and quizzes
15	4	Internal modification methods	divided differences method	Theoretical Lecture and discussion	2nd Midterm exam

11. Course Evaluation

Couse evolution of a student including the sum of the following two parts

1. Formative Evalution 40%
   (2 exams through the term 30% and Oral discussion 5% and Quizzes 5%)
2. Summative Evalution
   (Final Exam 60%)

12. Learning and Teaching Recourses

Required textbook(Curricular book, if any):

-Numerical Analysis, Puma Chanadra Biswal (2008)

Main References (Sources):

1. Butcher, J. C. (2016). *Numerical methods for ordinary differential equations*. John Wiley & Sons.

2. Dormand, J. R. (2018). *Numerical methods for differential equations: a computational approach*. CRC press.

Recommended book and references (Scientific journals, reports,…):

Electronic Reference ,Web sites:

https://scholar.google.com/scholar?hl=en&as_sdt=0,5&q=Numerical+Methods+For+Differential+Equations+A+Computational+Approach#d=gs_cit&t=1711840744034&u=%2Fscholar%3Fq%3Dinfo%3A3wm8DutzH7sJ%3Ascholar.google.com%2F%26output%3Dcite%26scirp%3D0%26hl%3Den