هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

Course Specification

— (Bachelor)

Course Title: **Numerical methods**

Course Code: **Math254**

Program: **Computer Science**

Department: : **Computer Science**

College: Computer and information Sciences

Institution: **Majmaa University**

Version: **2023**

Last Revision Date: 14/09/2023

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3,1,0)

2. Course type

A.	☐University	☐College	☐Department	☒ Track	☐Others
B.	☒ Required			☐Elective	

3. Level/year at which this course is offered: (Level 7)

4. Course general Description: Mathematics

5. Pre-requirements for this course (if any): Mh 223 (Differential Equations)

6. Pre-requirements for this course (if any):

7. Course Main Objective(s):

The course will introduce students to mathematical techniques that can be applied to various applications. Along with these methods students will also investigate specific examples of application where appropriate. The students will also study generic and bespoke software, such as MATLAB. Students will become familiar with current trends in the application of computational methods in a number of application disciplines.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning	60	
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	45
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	15
5.	**Others (specify)**	
Total		60

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1				
1.2				
...				
2.0	**Skills**			
2.1	CLO1. Apply standard techniques to analyze key properties of numerical algorithms such as stability and convergence	C2	Classroom Teaching	Quiz, Assignments, Mid Exam, Final Exam
2.2	CLO2. Understand and analyze common pitfalls in numerical computing such as ill-conditioning and Instability	C2	Classroom Teaching	Quiz, Assignments, Mid Exam, Final Exam
2.3	CLO3. Perform data analysis efficiently and accurately using data fitting methods	C2	Classroom Teaching	Quiz, Assignments, Mid Exam, Final Exam
2.4	CLO4. Derive and analyze numerical methods for First Order ODEs. and PDEs	C2	Classroom Teaching	Quiz, Assignments, Mid Exam, Final Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.5	CLO5. Perform optimization using well-established algorithms	C2	Classroom Teaching	Quiz, Assignments, Mid Exam, Final Exam
2.6	CLO6. Implement a range of numerical algorithms efficiently in Matlab	C2	Classroom Teaching	Quiz, Assignments, Mid Exam, Final Exam
3.0	Values, autonomy, and responsibility			
3.1				
3.2				
…				

C. Course Content

No	List of Topics	Contact Hours
1.	Topics include the standard algorithms for numerical computation: Programming and Software Root finding for nonlinear equations: Simple Fixed-Point Iteration	4
6	The Bisection Method, The False-Position Method	4
3.	Secant Method	4
4.	Brent's Method	4
5.	Newton-Raphson Method	4
6.	Interpolation: Newton's Divided-Difference Interpolating Polynomials	4
7.	Lagrange Interpolating Polynomials	4
8.	Newtons forward, and backward interpolation	4
9.	Numerical solutions: Ordinary Differential Equations Euler's Method Improvements of Euler's Method	4
10.	Runge-Kutta Methods, Solution of Systems of Equations, Adaptive Runge -Kutta Methods	4
11.	Boundary Value Problems: The Shooting Method	4
12.	Numerical optimization: One-dimensional Unconstrained Optimization, Golden-section search	4
13.	Multidimensional Unconstrained Optimization: Random Search	4
14.	Newton's, Parabolic interpolation methods	
15.	Revision	4

Total	60

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quiz 1	Week 4,	10%
2.	Assignment 1	Week 7,	10%
3.	Mid Term Exam	Week 8	20%
4.	Assignment 2	Week 13	10%
5.	Quiz 2	Week 12	10%
6.	Final Exam	Week 16	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Steven C. Chapra & P. Canale ,Numerical Methods for Scientists and Engineers: McGraw-Hill Science Engineering, 3/e ,2011
Supportive References	Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2011, 10th edition
Electronic Materials	
Other Learning Materials	MATLAB

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Class Room, PC
Technology equipment (projector, smart board, software)	LCD Projector, Dev C++/Visual studio C++
Other equipment (depending on the nature of the specialty)	Internet connevtion

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching		

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of Students assessment	Faculty	Direct
Quality of learning resources	students	Indirect
The extent to which CLOs have been achieved	Program Leaders	Direct
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	DR. AHMED A. FARGHALY
REFERENCE NO.	170986
DATE	14/09/2023