Course Specification

(Postgraduate Programs)

Course Title:	Advanced Engineering Mathematics
Course Code:	CE6003
Program:	Master of Science in Computer Engineering
Department:	Computer and Network Engineering
College:	College of Computing
Institution:	Umm Al-Qura University
Version:	2.0
Last Revision Date:	12/4/2025

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)				
2. Course type				
A.	☐University	☐College	☒ Department	☐Track
B.	☒ Required		☐Elective	
3. Level/year at which this course is offered: (Level 1)				
4. Course General Description:				
The course covers such fundamentals of mathematical tools as required in a typical graduate engineering program. Hence, it covers advanced topics in areas of linear algebra, vector differential and integral calculus, optimization, probability, and statistics.				
5. Pre-requirements for this course (if any)**:**				
None				
6. Co-requisites for this course (if any)**:**				
None				
7. Course Main Objective(s):				
To give the students an overview and a solid background of mathematical tools required in a typical graduate program in computer engineering to help them in technical courses as well as in their project.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100
2	E-learning		
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**	
5.	**Others (specify)……**	
	Total	45

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

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Explain fundamental concepts in probability for data analysis	K2	Lectures	Written Exams and Assignments
2.0	**Skills**			
2.1	Acquire and apply knowledge of probability for data analysis	S2	Lectures	Written Exams and Assignments
2.2	Solve problems in linear algebra	S1	Lectures	Written Exams and Assignments
2.3	Solve problems in the area of vector differential calculus	S1	Lectures	Written Exams and Assignments
2.4	Solve problems in the area of vector integral calculus	S1	Lectures	Written Exams and Assignments
2.5	Use optimization methods to solve optimization problems	S1	Lectures	Written Exams and Assignments
3.0	**Values, autonomy, and responsibility**			

C. Course Content:

No	List of Topics	Contact Hours
1.	Introduction to Computational Tools and Error Principles: Absolute and Relative errors, Rounding and Chopping; Error Propagation; Basic Error Principle. Introduction to Matlab or Python and computer implementation of mathematical techniques	6
2.	Finite and infinite series; Covergence tests; Power Seriers; Maclaurin and Taylor Series	3
3.	Linear Algebra: Matrices, Vectors, Determinants. Linear Systems (Ch7); Linear Algebra: Matrix eigenvalue problem, determining eigenvalues and eigenvectors (8.1) ,	6
4.	Vector Differential Calculus: Vectors in 2-space and 3-space, inner product, vector product, vector and scalar functions. Calculus Review (9.1, 9.2, 9.3, 9.4,9.6)	6
5.	Vector integral calculus: Line integrals, path independence; Calculus Review: Double Integrals (10.1, 10.2, 10.3)	6
6.	Optimization: Unconstrained optimization, steepest descent, linear programming, simplex method, applications of optimization in Engineering	6
7.	Review of probability theory: random variables, probability distributions, mean and variance of a distribution, binomial, poisson, and normal distributios	6
8.	Mathematical statistics: Random sampling, point estimation of parameters, confidence intervals, hypothesis testing, quality control, acceptance sampling, goodness of fit (X^2 test), regression, correlation	6
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes	Throughout the semester	20
2.	Midterms	6, 10	30
3.	Assignments	Throughout the semester	20
4.	Final exam	15	30

*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	Advanced Engineering Mathematics By Erwin Kreyszig, Herbert Kreyszig, and Edward J. Norminton. 10th Edition. Wiley, 2011, ISBN-10: 0470458364, ISBN-13: 978-0470458365

	Numerical Methods for Engineers by Steven C. Chapra and Raymond P. Canale, 7th Edition, McGraw-Hill, 2014, ISBN-10: 007339792X, ISBN-13: 978-0073397924 Thomas' Calculus by George Thomas Jr., Maurice Weir, Joel Hass, 13th Edition, 2014, ISBN-10: 0321878965, ISBN-13: 978-0321878960
Supportive References	Advanced Engineering Mathematics by Dennis Zill, 7th Edition, Jones & Bartlett Learning, 2020, ISBN-10: 1284206246 Applied Statistics and Probability for Engineers by Douglas C. Montgomery and George C. Runger, 7th Edition, Wiley, 2020, ISBN-10: 1119746353, ISBN-13: 978-1119746355
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**Classrooms**
Technology equipment (Projector, smart board, software)	**Projector**
Other equipment (Depending on the nature of the specialty)	**Matlab Software**

F. Assessment of Course Quality:

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

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	Computer and Network Engineering Department Council
REFERENCE NO.	The 18th Session Of The Academic Year 1446
DATE	15/4/2025