Course Specification
(Bachelor)

Course Title:	Calculus 2 for Engineering
Course Code:	MTH1182
Program:	Bachelor Engineering Programs (1*st* year/ 2*nd* level)
Department:	Mathematics
College:	College of Engineering
Institution:	Umm Al Qura University
Version:	1.0
Last Revision Date:	30/01/2025

Table of Contents

A. General information about the course 3

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods 4

C. Course Content 6

D. Students Assessment Activities 6

E. Learning Resources and Facilities 6

F. Assessment of Course Quality 7

G. Specification Approval 7

A. General information about the course:

1. Course Identification

1. Credit hours: (4)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: **Bachelor of Computer and Networks Engineering - (1st year/ 2nd level)** **BSc in Software Engineering - (2nd year/ 3rd level)**					
4. Course General Description:					
This course builds upon the foundational knowledge of Calculus I, focusing on advanced integration techniques, transcendental functions, indeterminate forms, and improper integrals. The course also explores applications of definite integrals, including areas, volumes, and curve lengths, as well as infinite series and power series with a focus on Taylor and Maclaurin series.					
5. Pre-requirements for this course (if any)**:**					
MTH1181 - Calculus 1 for Engineering					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					
The course aims to equip students with advanced skills in integration techniques, handling indeterminate forms and improper integrals, and applying definite integrals in various practical contexts. Additionally, the course introduces infinite sequences, series, and power series, enabling students to perform series expansions and approximations critical to scientific and engineering applications..					

2. Teaching mode (mark all that apply)

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

No	Mode of Instruction	Contact Hours	Percentage
	• Traditional classroom • E-learning		
4	Distance learning	-	-

3. Contact Hours (based on the academic semester)

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

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods (Bachelor of Computer and Networks Engineering)

Code	Course Learning Outcomes	Code of PLOs	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	An ability to identify and explain the broad in-depth knowledge and comprehension of Fundamental Theorems of Calculus, Differentiate and integrate transcendental functions, inverse trigonometric, and hyperbolic functions.	K1	One or more of the following strategies may be used: • Classroom lectures • PowerPoint slides • Reading assignments	One or more of the following strategies may be used: • Written exams, • Home assignments • Oral questions
2.0	**Skills**			
2.1	An ability to identify, formulate, and solve problems in: advanced integration techniques, such as integration by parts, trigonometric substitution, and partial fraction decomposition, improper integrals, convergence or divergence of infinite sequences and series using appropriate convergence test	S1	Lectures	Exams, Quizzes, Homework Exams, Quizzes, Homework
2.3	An ability to apply definite integrals to calculate areas, volumes, and lengths of curves in practical contexts.	S1	Lectures	Exams, Quizzes, Homework

Code	Course Learning Outcomes	Code of PLOs	Teaching Strategies	Assessment Methods
2.4	An ability to determine the convergence or divergence of infinite sequences and series using appropriate convergence tests.	S1	Lectures	Exams, Quizzes, Homework
2.5	Represent functions as power series and compute Maclaurin and Taylor series expansions for common functions.	S1	Lectures	Exams, Quizzes, Homework
2.6	Evaluate the accuracy and error estimates of Taylor series approximations in real-world applications.	S1	Lectures	Exams, Quizzes, Homework
3.0	**Values, autonomy, and responsibility**			

Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods (BSc in Software Engineering)

Code	Course Learning Outcomes	Code of PLOs	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	An ability to identify and explain the broad in-depth knowledge and comprehension of Fundamental Theorems of Calculus, Differentiate and integrate transcendental functions, inverse trigonometric, and hyperbolic functions.	K1	One or more of the following strategies may be used: • Classroom lectures • PowerPoint slides • Reading assignments	One or more of the following strategies may be used: • Written exams, • Home assignments • Oral questions
2.0	**Skills**			
2.1	An ability to identify, formulate, and solve problems in: advanced integration techniques, such as integration by parts, trigonometric substitution, and partial fraction decomposition, improper integrals, convergence or divergence of infinite sequences and series using appropriate convergence test	S1	Lectures	Exams, Quizzes, Homework Exams, Quizzes, Homework
2.2	An ability to apply definite integrals to calculate areas, volumes, and lengths of curves in practical contexts.	S1	Lectures	Exams, Quizzes, Homework
2.3	An ability to determine the convergence or divergence of infinite sequences and series using appropriate convergence tests.	S1	Lectures	Exams, Quizzes, Homework
2.4	Represent functions as power series and compute Maclaurin and Taylor series expansions for common functions.	S1	Lectures	Exams, Quizzes, Homework
2.5	Evaluate the accuracy and error estimates of Taylor series approximations in real-world applications.	S3	Lectures	Exams, Quizzes, Homework
3.0	**Values, autonomy, and responsibility**			

C. Course Content

No	List of Topics	Contact Hours
1.	**Review of the Fundamental Theorem of Calculus**	**8**
2.	**Transcendental functions:** natural logarithm, inverse functions and their derivatives, natural exponent function, general exponent and logarithm functions, inverse trigonometric functions and their derivatives, and hyperbolic functions and their inverses.	**12**
3	**Techniques of integration:** basic integration rules, integration by parts, some trigonometric integrals, rationalizing substitutions, integration by parts, and integration of rational functions using partial functions	**10**
4	**Indeterminate forms:** type 0/0, other forms, improper integrals: infinite limits of integrals, and infinite integrals	**10**
5	**Applications of the definite integral:** areas of plane region, volumes of solids, volume of solids of revolution, and length of plane curve.	**10**
6	**Infinite Series:** Infinite Sequences; Infinite Series; Positive Series; Alternating Series, Absolute Convergence, and Conditional Convergence;	**10**
Total		60

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Two Major Exams**	**6^{th} or 7^{th} 11^{th} or 12^{th}**	**%20 + %20**
2.	**Quizzes and Assignments**	**Continuous**	**%20**
3.	**Final Exam**	**17th or 18th**	**%40**
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*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	Purcell, E. J., D. Varberg, and S. E. Rigdon. "Calculus (9th Editio)." (2007).
Supportive References	Thomas, George B., Maurice D. Weir, and Joel Hass. "Thomas' Calculus: Multivariable." (2010).

	Stewart, James, Lothar Redlin, and Saleem Watson. Precalculus: Mathematics for Precalculus 6th Edition
Electronic Materials	
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• **Classrooms**
Technology equipment (projector, smart board, software)	• **Data Show**
Other equipment (depending on the nature of the specialty)	• **Black bord**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct
Effectiveness of Students assessment	Instructor	Direct
Quality of learning resources	Students	Direct
The extent to which CLOs have been achieved	Instructor	Direct
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

Council / Committee	**ACADEMIC CURRICULUM AND PLANS COMMITTEE IN COLLEGE OF ENGINEERING AND ARCHITECTURE**
Reference No.	
Date	**30/01/2025**

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Ministry Of Education-Umm Al-Qura University