هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission
اعتماد
NCAAA
2024
TP-153

Course Specification
(Bachelor)

Course Title:	**Calculus (1)**
Course Code:	**MAT 1101**
Program:	**Bachelor of Science in Applied Mathematics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**2024 – V1**
Last Revision Date:	**08/10/2024**

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A. General information about the course:

1. Course Identification

1. Credit hours:					
4 (3 Lectures, 0 Lab, 2 Tutorial)					
2. Course type					
A.	☐University	☒ College	☐ Program	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: Level 1 / Year 1					
4. Course general Description:					
Calculus (1) provides a solid foundation for advanced studies and practical applications in mathematics. Indeed, it introduces essential mathematical concepts, starting with solving linear and quadratic equations, polynomials, and inequalities, along with functions and their domains, ranges, and operations. It covers trigonometric functions and sequences, followed by an exploration of limits and continuity, including limit theorems and asymptotes. The course focuses on differentiation, teaching how to compute derivatives and apply them to concepts like tangent lines and velocity. Finally, students learn to optimize functions, analyze monotonicity, and determine concavity.					
5. Pre-requirements for this course (if any):					
None.					
6. Co-requisites for this course (if any):					
None.					
7. Course Main Objective(s):					
The course aims to establish a solid foundation in algebra and functions, covering topics such as solving equations and inequalities, analyzing polynomials, and understanding trigonometric concepts. It also focuses on limits and continuity, differentiation techniques, and their applications, including optimization and graph analysis.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	100%
2	E-learning	0	0%
3	Hybrid • Traditional classroom • E-learning	0	0%
4	Distance learning	0	0%

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	45
2.	**Laboratory/Studio**	0

3.	**Field**	0
4.	**Tutorial**	30
5.	**Others (specify)**	0
Total		75

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	Demonstrate an understanding of key algebraic concepts, including solving linear equations and inequalities, working with absolute value, and factoring polynomials.	K1,	Lectures and tutorials	Quizzes and written definitions
1.2	Understand the principles of trigonometry, including the unit circle, important identities, and the properties of sine, cosine, tangent, and their inverses.	K1, K2	Interactive discussions and group work	Concept maps and homework assignments
1.3	Understand the core concepts of limits, continuity, and differentiation, and their significance in the context of calculus	K1	Tutorials and guided problem-solving sessions	Multiple-choice exams and problem sets
2.0	**Skills**			
2.1	Apply appropriate differentiation techniques such as the power rule, chain rule, product rule, and quotient rule to compute derivatives of functions.	S1	Problem-based learning, workshops, tutorials, and hands-on practice.	Problem sets in assignments
2.2	Analyze and graph functions using differentiation, applying techniques like the first and second derivative tests to identify critical points, maxima, minima, and concavity.	S2	Hands-on workshops with graphing software, tutorials, and guided practice.	Assignments; and Class participation and feedback.
2.3	Solve complex problems involving trigonometric, exponential, and logarithmic functions, as well as arithmetic and geometric sequences, using calculus-based methods.	S3, S4	Lectures on convergence tests, group discussions, tutorials, and presentations.	Exams and class participation
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate autonomy in applying mathematical concepts to solve real-	V1	Group activities, peer review sessions,	Direct: Group evaluations; Indirect: Reflection

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	world problems, ensuring accuracy and ethical reasoning.		tutorials, and collaborative projects.	on group dynamics and peer feedback.
3.2	Take responsibility for one's own learning and development in mathematics by utilizing critical thinking and problem-solving skills in individual and group contexts.	V2	Independent study assignments, self-directed projects, tutorials, and reflective journaling.	Direct: Individual assignments; Indirect: Reflective journals and self-assessment.

C. Course Content

No	List of Topics	Contact Hours
1.	**Precalculus:** Solving Linear Equations and Inequalities, Absolute value, Solving Inequalities Containing an Absolute Value, Equations of lines, Quadratic Equations and Inequalities, Special Product Formulas, Polynomials, Factoring Polynomials; Functions: Domain, Range, and graphs of functions, Common Functions, Composition of functions, Inverse function; Trigonometry: Unit Circle, Angles and their Measurements, Solving Equations Involving Sines and Cosines, Important Trigonometric Identities, Trigonometric Functions (Sine, Cosine, and Tangent Function), Inverses Trigonometric Functions, Exponential and Logarithmic Functions, Laws of Exponents and Logarithms. Arithmetic and geometric sequences.	20
2.	**Limits and Continuity:** The Concept of Limit, Formal definition of limit, Limit Theorems, Limits Involving Infinity, Asymptotes, The natural number e as a limit, Continuity of functions, Operations on continuous functions, Intermediate value theorem, The Bisection Method, Formal definition of the limit.	15
3.	**Differentiation:** Tangent Lines and Velocity, The Derivative, Computation of Derivatives: The Power Rule, Higher Order Derivatives, The Product and Quotient Rules, The Chain rule, Derivatives of Trigonometric Functions and their inverses, Derivatives of Exponential and Logarithmic Functions, Implicit Differentiation, The Rule Theorem, The Mean Value Theorem.	20
4.	**Applications of Differentiation:** Indeterminate Forms and L'Hopital's Rule, Maxima and minima values, Monotonic functions and the first derivative test, Concavity and the second derivative test, Graphing functions.	20
Total		**75**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homeworks, Quizzes, participation	During the term	10%
2.	First Midterm	Week 5-6	25%

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
3.	Second Midterm	Week 10-11	25%
4.	Final Exam	Week 15-16	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	***Calculus***, 4th Edition, R. T. Smith, R. B. Minton, McGraw-Hill, 2012. **(Main Reference)**
Supportive References	1. ***Calculus***; O. Swokowski, et al, PWS Pub. Co.; 6th Edition, 1994. 2. ***Calculus: Early Transcendentals***, 7th Edition; C. Henry Edwards, David E. Penney, Pearson Prentice Hall, 2008. 3. ***Essential Calculus with Application***; Richard A. Silverman, Dover Publications, 1989. 4. ***Schaum's Outline of Calculus***, 6th Edition; Frank Ayres, Elliott Mendelson, McGraw-Hill, 2013.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• **Classrooms:** Equipped with whiteboards, projectors, and Smart Boards for interactive lessons and group discussions. • **Laboratories:** Feature computers with internet access, enabling hands-on activities and exploration of algebraic and trigonometric concepts. • **Exhibition Rooms:** Spaces for showcasing projects and presentations to encourage collaborative learning.
Technology equipment (projector, smart board, software)	• **Data Show Projectors:** For clear presentations in classrooms and labs. • **Smart Boards:** To enhance interactivity during lessons. • **Mathematical Software:** Essential for graphing and analysis.
Other equipment (depending on the nature of the specialty)	• **Computers:** For mini-projects and homework and practical applications in laboratories. • **Advanced Calculators:** For computations and problem-solving and supporting the study of limits, continuity, and differentiation. • **Whiteboards and Markers:** To facilitate brainstorming and collaboration.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Student and teaching staff**	**Surveys and Questionnaires**
Effectiveness of Students assessment	**Course Coordinator**	**Peer Reviews**

Assessment Areas/Issues	Assessor	Assessment Methods
Quality of learning resources	**Students and teaching staff**	**Classroom Observations**
The extent to which CLOs have been achieved	**Student Representatives**	**Student Performance Evaluations (exams, projects) CLOs Excel sheet.**
Other	**None**	

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
REFERENCE NO.	**8/1446**
DATE	**05/04/1446 (08/10/2024)**