Course Specification
(Bachelor)

Course Title:	**Calculus (1)**
Course Code:	**MAT 1101**
Program:	**Bachelor of Science in Physics**
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	Define key concepts related to linear equations, absolute value inequalities, and polynomial factoring.	K1,	Lectures and tutorials	Quizzes and written definitions
1.2	Describe the fundamental characteristics of functions, including domain, range, and composition.	K1, K2	Interactive discussions and group work	Concept maps and homework assignments
1.3	Recall the definitions of limits and continuity, and the processes for computing derivatives.	K1	Tutorials and guided problem-solving sessions	Multiple-choice exams and problem sets
2.0	**Skills**			
2.1	1. Utilize appropriate integration techniques, including substitution and integration by parts, to effectively solve complex problems involving definite and improper integrals.	S1	Problem-based learning, workshops, tutorials, and hands-on practice.	Problem sets in assignments
2.2	2. Construct graphical representations of functions and curves described by parametric equations, accurately determining arc lengths and surface areas using calculus methods.	S2	Hands-on workshops with graphing software, tutorials, and guided practice.	Assignments; and Class participation and feedback.
2.3	3. Evaluate the convergence of infinite series by applying various convergence tests and effectively communicate the results through written explanations and presentations.	S3, S4	Lectures on convergence tests, group discussions, tutorials, and presentations.	Exams and class participation
3.0	**Values, autonomy, and responsibility**			
3.1	1. Demonstrate ethical responsibility by collaborating effectively with peers, fostering a respectful and inclusive learning environment during group activities and projects.	V1	Group activities, peer review sessions, tutorials, and collaborative projects.	Direct: Group evaluations; Indirect: Reflection on group dynamics and peer feedback.
3.2	2. Cultivate self-directed learning by engaging in independent study and	V2	Independent study assignments, self-	Direct: Individual assignments;

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	reflection, recognizing the importance of personal responsibility in mastering calculus concepts.		directed projects, tutorials, and reflective journaling.	Indirect: Reflective journals and self-assessment.

C. Course Content

No	List of Topics	Contact Hours
1.	**Equations and Inequalities:** Solving Linear Equations and Inequalities, Absolute value, Solving Inequalities Containing an Absolute Value, Equations of lines, Quadratic Equations and Inequalities, Special Product Formulas.	10
2.	**Functions:** Domain, Range, and graphs of functions, Common Functions, Composition of functions, Inverse function; Exponential and Logarithmic Functions, Laws of Exponents and Logarithms.	10
3.	**Trigonometry:** Unit Circle, Angles and their Measurements, Important Trigonometric Identities, Trigonometric Functions, Inverses Trigonometric Functions, Complex Numbers, Complex Numbers in Polar Form and De Moivre's Theorem.	10
4.	**Limits and Continuity:** The Concept of Limit, Computation of limits, Continuity of functions, Intermediate value theorem, Limits Involving Infinity, Asymptotes, Formal definition of the limit.	15
5.	**Differentiation:** Tangent Lines and Velocity, The Derivative, Computation of Derivatives: The Power Rule, The Product and Quotient Rules, The Chain rule, Derivatives of Trigonometric Functions, Derivatives of Exponential and Logarithmic Functions, Implicit Differentiation, The Mean Value Theorem.	15
6.	**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.	15
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%
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-project 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**
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)