



Course Specification

(Bachelor)

Course Title: **Calculus (2)**

Course Code: **MAT 1103**

Program: **Bachelor of Science in Chemistry**

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.	<input type="checkbox"/> University	<input type="checkbox"/> College	<input checked="" type="checkbox"/> Program	<input type="checkbox"/> Track	<input type="checkbox"/> Others
B.	<input checked="" type="checkbox"/> Required		<input type="checkbox"/> Elective		
3. Level/year at which this course is offered: Level 2 / Year 1					
4. Course general Description:					
Enhance and reinforce the knowledge of Calculus, gained by the Students in Calculus (1), with other topics which are essential to proceed to next courses in all programs. This course describes the most important ideas, theoretical results, and examples of definite integrals, infinite series, system of linear equations, matrices, determinants and ordinary differential equations. The course includes the essential fundamentals of these topics. The emphasis is on calculations, and some applications are mentioned.					
5. Pre-requirements for this course (if any):					
MAT 1101 Calculus (1)					
6. Co-requisites for this course (if any):					
None.					
7. Course Main Objective(s):					
<ul style="list-style-type: none"> To master advanced techniques of integration and apply them to practical problems such as calculating areas, volumes, and arc lengths. To gain a deep understanding of infinite series, including convergence tests and Taylor/Maclaurin series, and use them for function approximation. To explore matrices concept and methods of linear algebra. To apply techniques for solving first, second and higher order differential equations. 					

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 <ul style="list-style-type: none"> Traditional classroom E-learning 	0	0%
4	Distance learning	0	0%

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
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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	Explain the concepts of anti-derivatives, indefinite integrals, and the Fundamental Theorems of Calculus.	K1	Lectures and tutorials	Quizzes and written definitions
1.2	Summarize various techniques of integration, including substitution, integration by parts, and trigonometric techniques.	K2	Interactive workshops and collaborative learning	Homework assignments and in-class exercises
1.3	list appropriate series/ sequence test to decide the convergence or divergence of series/ sequences.	K1, K2	Lecture and class discussions	Exams and problem sets, participation
1.4	Describe methods for solving linear systems and computation of determinants.	K2	Lecture and class discussions	Exams and problem sets, participation
1.5	Outline ordinary differential equations.	K1	Lecture and class discussions	Exams and problem sets, participation
2.0	Skills			
2.1	Utilize appropriate integration techniques, including substitution and integration by parts, to effectively solve complex problems	S1, S2	Problem-based learning, workshops, tutorials, and hands-on practice.	Direct: Problem sets and project presentations; Indirect: Self-





Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	involving definite and improper integrals.			assessment surveys.
2.2	Construct graphical representations of functions and curves described by parametric equations, accurately determining arc lengths and surface areas using calculus methods.	S4	Hands-on workshops with graphing software, tutorials, and guided practice.	assignments; Class participation and feedback.
2.3	State, clearly and precisely both orally and in writing, the general solution of at most a 4×4 linear system using appropriate method of linear algebra matrix including Gaussian elimination and matrix inversion.	S4	Hands-on workshops with graphing software, tutorials, and guided practice.	assignments; Class participation and feedback.
2.4	Solve first-order and second order and high-order ordinary differential equations using the appropriate methods	S5	Lectures on convergence tests, group discussions, tutorials, and presentations.	Exams and class feedback.
3.0	Values, autonomy, and responsibility			
3.1	Demonstrate ethical responsibility by collaborating effectively with peers, fostering a respectful and inclusive learning environment during group activities and projects.	V1, V3	Group activities, peer review sessions, tutorials, and collaborative projects.	Direct: Group evaluations; peer feedback.
3.2	Cultivate self-directed learning by engaging in independent study and reflection, recognizing the importance of personal responsibility in mastering calculus concepts.	V1, V2	Independent study assignments, self-directed projects, tutorials, and reflective journaling.	Individual assignments; Indirect: Reflective journals and self-assessment.

C. Course Content

No	List of Topics	Contact Hours
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1.	Integration: Anti-derivatives, Indefinite Integral and its properties, Area under curves and The Definite Integral, First and Second Fundamental Theorems of Calculus, Integration by Substitution, Integration by Parts, Integration of Rational Functions Using Partial Fractions, Trigonometric Techniques of Integration, Integrals involving logarithmic, exponential, and hyperbolic functions, Improper Integrals.	20
2.	Infinite Series: Sequences of Real Numbers, Convergence and Divergence of Infinite Sequences, Infinite Series, Basic Infinite Series (geometric series, p-series, alternating series, telescoping series), Convergence Tests for Positive Series (ratio test, root test, comparison and limit comparison test, integral test), Alternating Series, Absolute and Conditional Convergence, Power Series.	20
3.	System of Linear Equations, Matrices, and Determinants: Solving Linear Systems, Matrix Notation, Augmented Matrix of a Linear System, Reduced Echelon Form a Matrix –Gaussian and Gauss Jordan Elimination, Algebra of Matrices, Inverse of a Square Matrix, Determinants.	20
4.	Ordinary Differential Equations: First Order Ordinary Differential Equations, Separable Equations and Integrating Factor, Second Order Ordinary Differential Equations.	15
Total		75

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	HomeWorks, Quizzes, Mini-projects	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	<ul style="list-style-type: none"> ▪ Calculus, 4th Edition; R. T. Smith, R. B. Minton, McGraw-Hill, 2012. (Main Reference) ▪ Linear Algebra, Gareth Williams Jones and Bartlett, 6th Ed., 2008. (Main Reference)
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Supportive References	<p><i>Advanced Engineering Mathematics, Dennis G. Zill, Warren S. Wright, Jones & Bartlett Publishers, 5th Ed., 2014.</i></p> <p><i>Essential Calculus with Application; Richard A. Silverman, Dover Publications, 1989.</i></p> <p><i>Linear Algebra, Schaum's Outline, S. Lipschutz, M. Lipson, McGraw-Hill, 3rd Ed., 2000.</i></p>
Electronic Materials	None
Other Learning Materials	None

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> Computers: For mini-project and homework and practical applications in laboratories. Advanced Calculators: For computations and problem-solving and supporting the study of integration, infinite series and parametric equations. 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)

