COURSE SPECIFICATION

Course Title:	**Calculus**
Course Code:	**4041101-4**
Program:	**BSc. Biology**
Department:	**Mathematical Science**
College:	**Applied Science**
Institution:	**Umm Al-Qura University**

Table of Contents

A. Course Identification

1. Credit hours: **4 hours**
2. Course type **a.** University ☐ College ☐ Department ☐ Others ☐ **b.** Required ☐ Elective ☐
3. Level/year at which this course is offered: First Level / First Year
4. Pre-requisites for this course (if any)**:** Does not exist.
5. Co-requisites for this course (if any)**:** Does not exist.

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	4 hours per week	100%
2	**Blended**	0	0%
3	**E-learning**	0	0%
4	**Correspondence**	0	0%
5	**Other**	0	0%

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	(4 hours) x (15 weeks)
2	**Laboratory/Studio**	0
3	**Tutorial**	0
4	**Others** (specify)	0
	Total	٦٠ hours
Other Learning Hours*		
1	**Study**	(1 hour) x (15 weeks)
2	**Assignments**	(1 hour) x (15 weeks)
3	**Library**	(1 hour) x (15 weeks)
4	**Projects/Research Essays/Theses**	0
5	**Others** (specify)	0
	Total	٤٥ hours

***** The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

Calculus is the first of the required courses in the mathematics program. This course provides a unique introduction to a course in single-variable calculus. Key topics of the course include real numbers, functions and graphing, limits and continuity, derivatives, derivative applications, integrals, and applications of integration. Concepts of differential and integral calculus is applied to trigonometric, inverse trigonometric, and transcendental functions.

2. Course Main Objective

The primary objective of the course is to introduce students to the concepts of calculus and to develop the student's confidence and skill in dealing with mathematical expressions. To achieve this goal, the course will help the student understand the following basic concepts: limits, continuity and derivatives involving real-valued functions of one variable (including algebraic, trigonometric, exponential, and logarithmic functions).

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge:**	
1.1	Recognize the characteristics of a function expressed in symbolic or graphic form.	
1.2	Outline the definitions of limits and continuity a single-variable function and their theorems.	
1.3	List the different rules, formulas and theorems of differentiation of real functions.	
1.4	Define the basic concepts and techniques of integration of polynomial, rational, transcendental and trigonometric functions.	
2	**Skills :**	
2.1	Analyze functions represented in a variety of ways: graphical, numerical or analytical.	
2.2	Determine the limits of functions and their continuity at points or on intervals.	
2.3	Calculate the derivative of various type of functions using the rules and techniques of differentiation.	
2.4	Apply the concept of derivative to completely analyze graph of a function.	
2.5	Evaluate integrals of real functions using basic rules and techniques of integration.	
3	**Competence:**	

CLOs		Aligned PLOs
3.1	Apply the computational and conceptual principles of calculus to the solutions of various mathematical problems.	
3.2	Use graphical information and symbolic expression simultaneously in solving problems.	
3.3	Justify the choice of different steps in problem resolution procedure.	

C. Course Content

No	List of Topics	Contact Hours
١	**Brief Review** - Real numbers. - Exponents and Radicals. - Polynomials: Basic Operations and Factoring. - Solving Equations. - Rational Expressions: Basic Operations. - Inequalities. - Absolute Values.	8
٢	**Functions** - Definition of Functions (Domain and Range) - Graphs of Functions - Operations on Functions - Trigonometric Functions and Identities.	8
٣	**Limits** - Introduction to Limits - Theorems on limits - Limit from Right and from Left - Definition of Continuity	8
٤	**Differentiation** - Definition of Derivative (Using Limits) - Rules and Theorems for Finding Derivatives - Derivative of Trigonometric Functions - Chain Rule - Higher Order Derivatives - Implicit Differentiation.	16
٥	**Applications of the derivative** - Maxima and Minima - Monotonicity - Local Maxima and Minima - Concavity - Sketching Graphs.	١٢
٦	**Integration** - Integration of Functions - Definite Integrals.	8

Total	60

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Recognize the characteristics of a function expressed in symbolic or graphic form.	Lecture. Memorization.	Exams (Midterm and Final). Quizzes.
1.2	Outline the definitions of limits and continuity a single-variable function and their theorems.	Lecture. Memorization.	Exams (Midterm and Final). Quizzes.
1.3	List the different rules, formulas and theorems of differentiation of real functions.	Lecture. Memorization.	Exams (Midterm and Final). Quizzes.
1.4	Define the basic concepts and techniques of integration of polynomial, rational, transcendental and trigonometric functions.	Lecture. Memorization.	Exams (Midterm and Final). Quizzes.
2.0	**Skills**		
2.1	Analyze functions represented in a variety of ways: graphical, numerical or analytical.	Lecture. Small group work.	Exams (Midterm and Final). Homework.
2.2	Determine the limits of functions and their continuity at points or on intervals.	Lecture. Small group work.	Exams (Midterm and Final). Homework.
2.3	Calculate the derivative of various type of functions using the rules and techniques of differentiation.	Lecture. Small group work.	Exams (Midterm and Final). Homework.
2.4	Apply the concept of derivative to completely analyze graph of a function.	Lecture. Small group work.	Exams (Midterm and Final). Homework.
2.5	Evaluate integrals of real functions using basic rules and techniques of integration.	Lecture. Small group work.	Exams (Midterm and Final). Homework.
3.0	**Competence**		
3.1	Apply the computational and conceptual principles of calculus to the solutions of various mathematical problems.	Lecture. Small group work.	Exams (Midterm and Final). Homework.
3.2	Use graphical information and symbolic expression	Lecture. Small group work.	Exams (Midterm and Final).

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	simultaneously in solving problems.		Homework.
3.3	Justify the choice of different steps in problem resolution procedure.	Lecture. Small group work.	Exams (Midterm and Final). Homework.

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm Test (1)	6th week	20%
2	Midterm Test (2)	12th week	20%
3	Homework and Quizzes	During the semester	10%
4	Final Examination	End of semester	50%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

Each group of students is assigned to a faculty member where he or she will provide academic advising. All faculty members are required to be in their offices outside teaching hours. Each faculty member allocates at least 4 hours per week to give academic advice and to answer to the questions of students about concepts studied during the lectures.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Calculus (9th Edition), Dale Varberg, Edwin Purcell and Steven Rigdon, Prentice Hall (2006).
Essential References Materials	Mathematics for preparatory year program (Book1), Oxford University Press (2013).
Electronic Materials	None.
Other Learning Materials	None.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Large classrooms that can accommodate more than 50 students.
Technology Resources (AV, data show, Smart Board, software, etc.)	Data Show.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment.	Students	Direct
Quality of learning resources.	Students	Direct
Extent of achievement of course learning outcomes.	Faculty member	Direct

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Council of the Mathematics Department
Reference No.	
Date	