Course Specification

(Bachelor)

Course Title:	Multivariable Calculus
Course Code:	MTH2104
Program:	BSc. in Mathematics
Department:	Mathematics
College:	Al-Qunfudah University College
Institution:	Umm Al-Qura University
Version:	2
Last Revision Date:	17/07/2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (4/2)					
4. Course general Description:					
Multivariable calculus is the fourth and the final part of the standard three-semester calculus sequence. It represent the extension of calculus in one variable to calculus with functions of several variables. This course treats topics related to differential calculus in several variables, integration in several variables. Multivariable calculus has many applications in various areas such as pure mathematics, engineering and physics.					
5. Pre-requirements for this course (if any)**: MTH1103-4**					
6. Pre-requirements for this course (if any)**:**					
7. Course Main Objective(s):					
The aim of this course is to provide students with fundamental concepts and techniques of multivariable calculus and to develop student understanding and skills for its applications to other areas.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	4	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**	36
2.	**Laboratory/Studio**	0
3.	**Field**	0
4.	**Tutorial**	0
5.	**Others (***Exam, Quizzes, Activities…***)**	4
Total		40

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	**Recognize mathematical formulas and methods of derivation of multivariable functions.**	*K3, K5*	**Lecture and Tutorials**	**Exams, quizzes**
1.2	**State the integration techniques to calculate multiple integrals in different coordinate systems**	*K1, K3*	**Lecture and Tutorials**	**Exams, quizzes**
2.0	**Skills**			
2.1	**Perform differential calculus operations on functions of several variables including continuity, partial derivatives and directional derivatives.**	*S1, S3,S6,S7*	**Lecture and Tutorials**	**Exams, quizzes**
2.2	**Estimate multiple integrals in different coordinate systems including Cartesian, polar, cylindrical and spherical coordinates.**	*S5, S9*	**Lecture and Tutorials**	**Exams, quizzes**
3.0	**Values, autonomy, and responsibility**			
3.1	**Apply the computational and conceptual principles of calculus to the solutions of various scientific applications.**	*V2*	**Lecture/ Individual or group work**	**Exams, quizzes**

C. Course Content

No	List of Topics	Contact Hours
1.	**The Derivative in n-space:** *- Functions of several variables.* *- Partial Derivatives* *- Limits and continuity* *- Differentiability* *- Directional Derivatives* *- The Chain rule* *- Tangent planes.* *- Approximations* *- Maxima and minima* *- Lagrange's method*	**17**
2.	**The integral in n-space:** *- Double integrals over rectangles* *- Double integrals over nonrectangular regions* *- Double integrals in polar coordinates* *- Surface area* *- Triple integrals in Cartesian, cylindrical and spherical coordinates*	**17**
3.	*Others* *Preprimaries, Quizzes, Activities…*	**6**
Total		**40**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Midterm exam**	**6th**	**30 %**
2.	**Quizzes and homework's**	**During semester**	**20 %**
3.	**Final exam**	**End of semester**	**50 %**

*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 with analytic geometry (7th Edition), Edwin J. Purcell, and Dale E. Varberg, Prentice Hall (1998).*
Supportive References	*Advanced engineering mathematics, Stanley I. Grossman, and William R. Derrick, Harper and Row, New York (1988).*
Electronic Materials	*None*
Other Learning Materials	*None*

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**Classrooms**
Technology equipment (projector, smart board, software)	**Data Show, Smart Board**
Other equipment (depending on the nature of the specialty)	**None**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Students**	**Courses Assessment survey**
Effectiveness of Students assessment		**Courses Assessment survey**
Quality of learning resources	**Students**	**Courses Assessment survey**
The extent to which CLOs have been achieved	**Faculty Member**	**Post-Rubric and Course report**
Periodically reviewing course effectiveness and planning for improvement	**Course committee**	**Annual report**

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Curriculum Committees
REFERENCE NO.	**1**
DATE	17/07/2024