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

Course Specification

(Bachelor)

Course Title:	**Multivariable Calculus (3)**
Course Code:	**MAT 1206**
Program:	**Bachelor of Science in Actuarial and Financial Mathematics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**2024 – V1**
Last Revision Date:	**None**

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A. General information about the course:

1. Course Identification

1. Credit hours:					
3 (2 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 3 / Year 2					
4. Course general Description:					
This course describes the most important ideas, theoretical results, and examples of Vectors and Geometry of Space, Vector-Valued Functions, Functions of several variables, and Multiple Integrals.					
5. Pre-requirements for this course (if any):					
MAT 1105					
6. Co-requisites for this course (if any):					
None.					
7. Course Main Objective(s):					
• To demonstrate the ability to work with different geometries in space. • To study functions of several variables and partial differentiation. • To be able to set up and compute multiple integrals in cartesian and polar coordinates. • To master vector operations in different coordinate systems.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	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**	30
2.	**Laboratory/Studio**	0
3.	**Field**	0
4.	**Tutorial**	30
5.	**Others (specify)**	0
Total		60

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	Describe parametric and polar curves in plane and recognize regions and quadric surfaces in space.	K1	4 lecture hours\week	Direct: Regular Exams
1.2	Recall double and triple integrals in different coordinate systems. in rectangular, polar, cylindrical, and spherical.	K3	• 2 tutorial hours\week • Self-study	Direct: Short Quizzes
2.0	**Skills**			
2.1	Apply the computational and conceptual principles of vector calculus, including partial derivatives and multiple integrals, to the solutions of various problems	S3	• Self-study • Real-life problems	Direct: • Participations • Short Quizzes
2.2	Interpret, clearly and precisely both orally and in writing, calculus operations on vector-valued functions including limits, derivatives, integrals, curvature, and the description of motion in plane and space.	S3	Self-study	Direct: Participations
2.3	Illustrate figures in different coordinates using a CAS and some online solvers.	S3	Real-life problems	Direct: Short Quizzes
2.4	Compute arc length /surface/volume of regions in 2 and 3 dimensions, in Cartesian, polar, cylindrical, and spherical coordinate systems, directional derivatives, equations of tangent planes, and gradient vectors.	S3	Self-study	Direct: Participations
3.0	**Values, autonomy, and responsibility**			
3.1	Argue the formulated conclusions.	V2	Personal questions	Direct: Participation
3.2	Debate meaningfully and productively with others.	V2	Teamwork and class discussions.	Direct: Homework and Mini projects

C. Course Content

No	List of Topics	Contact Hours
1.	**Vectors and Geometry of Space:** Vectors in Space, Dot Product, Cross Product, Equations of Lines and Planes in Space, Quadratic Surfaces in Space.	15
2.	**Vector-Valued Functions:** Vector-Valued Functions, Calculus of Vector Functions, Motion in Space, Curvature, Tangent and Normal Vectors.	15
3.	**Functions of several variables:** Functions of Several Variables, Limits and Continuity, Partial Derivatives, Differentiability, The Total Derivative, The Directional Derivatives and Gradient, Tangent Plane and Linear Approximation, Taylor's Theorem in Severable variables, Chain Rule, Maxima and Minima, Method of Lagrange Multipliers.	15
4.	**Multiple Integrals:** Double Integrals in Cartesian Coordinates, Areas and Volumes, Polar Coordinates, Double Integrals in Polar Coordinates, Surface Area, Triple Integrals in Cartesian Coordinates, Cylindrical and Spherical Coordinates, Triple Integrals in Cylindrical and Spherical Coordinates, Change of Variables in Multiple Integrals.	15
Total		**60**

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 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	• ***Advanced Engineering Mathematics, 8th Edition, E. Kreyszig, John Wiley & Sons, INC, 1998.*** • ***Calculus, 6th Edition, O. Swokowski, et al, PWS Pub. Co., 1994.*** • ***Calculus Early Transcendentals, 7th Edition; C. Henry Edwards, David E. Penney, Prentice Hall, 2008.*** • ***Calculus, 1st Edition, F. Ayres & E. Mendelson, Schaum's Outline McGraw-Hill, 1999.***
Electronic Materials	**None**
Other Learning Materials	**None**

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	▪ Each classroom should be equipped with a whiteboard and a projector. ▪ Laboratories should be equipped with computers and an internet connection.
Technology equipment (projector, smart board, software)	The rooms should be equipped with data show and 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	During the semester and at the end of the course each student will complete two evaluation forms.
Effectiveness of Students' assessment	Instructor	At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.
Quality of learning resources	Students	During the semester and at the end of the course each student will complete two evaluation forms.
The extent to which CLOs have been achieved	Instructor	At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.
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)