MA082 Multi-variable Calculus (Calculus III)

Instructor Information	Professor Yu Home Institution: Shanghai Jiao Tong University Email: gfyu@sjtu.edu.cn Office Hours: Determined by Instructor		
Term	June 27, 2022 - July 22, 2022	**Credits**	4 units
Class Hours	Monday through Friday, 120 mins per teaching day		
Discussion Sessions	2.5 hours each week, conducted by teaching assistant(s)		
Total Contact Hours	66 contact hours (1 contact hour = 45 mins, 3000 mins in total)		
Required Texts (with ISBN)	Calculus, by James Stewart, Eighth Edition. ISBN 978-0-538-49790-9		
Prerequisite	Students are expected to pass Calculus I, II		

Course Overview

This class mainly focuses on derivatives and integrals of multivariable functions. In the differential parts, Calculus III contains limits, continuity and partial derivatives of multivariable functions. We apply Taylor expansion formula to discuss maximum and minimum values of functions. Lagrange multipliers method is introduced to find extreme values of constrained problems. Multiple integrals part contains double integrals and triple integrals, line integrals and surface integrals. Some important theorems are introduced in vector fields, including Green formula, Gauss formula and Stokes formula.

Course Contents

On completion of this subject students should

1. Compute the scalar product and cross product of real vectors;
2. Have a good knowledge of equations of lines and planes in three-dimensional space;
3. Ability to compute the derivatives of both real scalar functions and real vector valued functions.
4. Apply Taylor theorem and Lagrange multiplier method to find the local and absolute maximum and minimum of functions.
5. Evaluate double integrals and triple integrals;
6. Apply Green's theorem, Gauss theorem and Stokes theorem and divergence theorem to evaluate line-integrals and surface-integrals.

Grading Policy

Assignments	20%
Midterm Test	40%
Final Examination	40%

Grading Scale

Number grade	Letter grade	GPA
90-100	A	4.0
85-89	A-	3.7
80-84	B+	3.3
75-79	B	3.0
70-74	B-	2.7
67-69	C+	2.3
65-66	C	2.0
62-64	C-	1.7
60-61	D	1.0
≤59	F (Failure)	0

Class Schedule

Date	Lecture	Readings
Day 1	The three-dimensional coordinate system. Vectors. The dot product of two real vectors.	Chapter 12.1 – 12.3
Day 2	The cross product. Equations of lines and planes	Chapter 12.4 – 12.5
Day 3	Vector functions and space curves. Derivatives and integrals of vector functions	Chapter 13.1 – 13.2
Day 4	Arc length and curvature. Motion in space: velocity and acceleration	Chapter 13.3 – 13.4
Day 5	Functions of several variables. Limits and continuity.	Chapter 14.1 – 14.2
Day 6	Partial derivatives. Tangent planes and linear approximations	Chapter 14.3 – 14.4
Day 7	The chain rule. Directional derivatives and the gradient vector	Chapter 14.5 – 14.6
Day 8	Maximum and minimum values. Lagrange multipliers	Chapter 14.7 – 14.8
Day 9	Review for the first midterm examination	Chapters 12, 13, 14
Day 10	Midterm Exam	Chapters 12, 13, 14
Day 11	Double integrals over rectangles. Double integrals over general domains	Chapter 15.1 – 15.3
Day 12	Double integrals in polar coordinates. Surface area	Chapter 15.4 – 15.6
Day 13	Triple integrals. Triple integrals in cylindrical coordinate. Triple integrals in spherical coordinates	Chapter 15.7 – 15.9
Day 14	Change of variables in multiple integrals Vector fields	Chapter 15.10 & Chapter 16.1
Day 15	Line integrals.	
Day 16	The fundamental theorem for line integrals	Chapter 16.2 – 16.3
Day 17	Green’s theorem. Curl and divergence	Chapter 16.4 – 16.5
Day 18	Parametric surfaces and their areas. Surface integrals	Chapter 16.6 – 16.7
Day 19	Stokes theorem. The divergence theorem.	Chapter 16.8 – 16.9
Day 20	Review for the final examination	Chapters 12 - 16