



Shanghai Jiao Tong University

MA082 Multi-variable Calculus (Calculus III) (Online)

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|------------------------------------|---|-----------------|---------|
| Instructor Information: | TBD | | |
| Term: | June 29, 2020 – July 30, 2020 | Credits: | 4 units |
| Class Hours: | Monday through Thursday, 120 minutes per teaching day | | |
| Discussion Sessions: | 2 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): | N/A | | |
| 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, double integrals, triple integrals and surface integrals.



Grading Policy

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|-------------------|-----|
| 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. The fundamental theorem for line integrals | Chapter 16.2 – 16.3 |
| Day 16 | Green's theorem. Curl and divergence | Chapter 16.4 – 16.5 |
| Day 17 | Parametric surfaces and their areas. Surface integrals | Chapter 16.6 – 16.7 |
| Day 18 | Stokes theorem. The divergence theorem. | Chapter 16.8 – 16.9 |
| Day 19 | Review for the final examination | Chapters 12 - 16 |
| Day 20 | The Final Examination | Chapters 12 - 16 |