East China Normal University
GEC International Summer School

MAT 23: Calculus 3

Term: June 17ᵗʰ to July 19ᵗʰ, 2024
Class Hours: Monday through Friday, 110 minutes each day (2,750 minutes in total)
Instructor: TBD
Home Institution: TBD
Office hours: TBD
Email: TBD

Course Description

This course focuses on calculus in higher dimensions. Topics include limits, continuity, differentiability, directional derivatives, optimization, geometry of curves, multiple integrals, general coordinate systems, path and surface integrals, vector calculus, theorems of Gauss, Green, and Stokes, applications.

Prerequisite: MAT12 Calculus 2

Learning Objective

Students should become comfortable working in three-dimensional space:

1. Work with rectangular, cylindrical, and spherical co-ordinate systems

2. Work with general coordinate transformations and apply them to change variables in double and triple integrals.

3. Feel confident working with vectors and the standard operations involving them such as the dot and cross product.

4. Compute partial derivatives of any of the functions encountered in Calc I & II with multiple variables.

5. Compute double and triple integrals

6. Solve simple optimization problems with multiple variables

7. Compute div, grad, curl of a vector function

8. Use Green's Theorem

9. Use Divergence Theorem

10.   Use Stoke's Theorem

Required Text

Multivariable Calculus, 9th edition, by James Stewart, Daniel K. Clegg, Saleem Watson

ISBN: 9780357042922

Course Hours

The course has 25 class sessions in total. Each class session is 110 minutes in length, for a total of 2750 minutes of in-class time. The course meets from Monday to Friday. ECNU awards 3 credits for this course. Different universities may count course credits differently. Consult officials at your own home institution.

Attendance

Summer school is very intense and to be successful, students need to attend *every class*. Occasionally, due to illness or other unavoidable circumstance, a student may need to miss a class. ECNU policy requires a medical certificate to be excused. Any absence may impact on the student's grade. Moreover, ECNU policy is that a student who has more than 3 absences will fail the course. Arriving late or leaving early will count as a partial absence.

Grading Policy

ECNU awards grades of A, A-, B+, B, B-, C+, C, D, and F. Most colleges and universities do not award transfer credit for grades of D or F.

In this course, grading will be based on the following:

Attendance and Participation	5%
Assignments*5	5%*5=25%
Midterm Exam	30%
Final Exam	40%

General Expectations

Students are expected to:
- Attend all classes and be responsible for all material covered in class and otherwise assigned. Any unexcused absence may impact a student's grade.
- Arrive to class on-time: Late arrivals are disruptive to your fellow students and to the conduct of the class.
- Complete the day's required reading and assignments before class
- Review the previous day's notes before class; make notes about questions you have about the previous class or the day's reading
- Refrain from texting, phoning or engaging in computer activities unrelated to class during class (不要用手机) It is highly disrespectful to the professor and to the class.
- Participate in class discussions and complete required written work on time.

Course Schedule

The planned schedule sketched out below may be modified to suit the interests or abilities of the enrolled students or to take advantage of special opportunities or events that may arise during the term.

Week 1

- *Day 1*
    - *Course outline*
    - *Review of MAT21 - Parametric Equations and Polar Coordinates (Chapter 10)*
- *Day 2*
    - *Review of MAT21 – Sequences, Series, and Power Series (Chapter 11)*

- *Day 3*
  - *Vectors and the Geometry of Space (Chapter 12)*
    - *Three-Dimensional Coordinate Systems (12.1)*
    - *Vectors (12.2)*
    - *The Dot Product (12.3)*
    - *The Cross Product (12.4)*
- *Day 4*
  - *Vectors and the Geometry of Space (Chapter 12, continued)*
    - *Equations of Lines and Planes (12.5)*
    - *Cylinders and Quadric Surfaces (12.6)*
- *Day 5*
  - *Assignment 1 due*
  - *Vector Functions (Chapter 13)*
    - *Vector Functions and Space Curves (13.1)*
    - *Derivatives and Integrals of Vector Functions (13.2)*

Week 2

- *Day 1*
  - *Vector Functions (Chapter 13, continued)*
    - *Arc Length and Curvature (13.3)*
    - *Motion in Space: Velocity and Acceleration (13.4)*
- *Day 2*
  - *Partial Derivatives (Chapter 14)*
    - *Functions of Several Variables (14.1)*
    - *Limits and Continuity (14.2)*
- *Day 3*
  - *Partial Derivatives (Chapter 14, continued)*
    - *Partial Derivatives (14.3)*
    - *Tangent Planes and Linear Approximations (14.4)*
- *Day 4*
  - *Partial Derivatives (Chapter 14, continued)*
    - *The Chain Rule (14.5)*
    - *Directional Derivatives and the Gradient Vector (14.6)*
- *Day 5*
  - *Assignment 2 due*
  - *Partial Derivatives (Chapter 14, continued)*
    - *Maximum and Minimum Values (14.7)*

Week 3

- *Day 1*
  - *Partial Derivatives (Chapter 14, continued)*
    - *Lagrange Multipliers (14.8)*
- *Day 2*
  - *Midterm exam, covering material up to 14.7*
- *Day 3*
  - *Multiple Integrals (Chapter 15)*
    - *Double Integrals (15.1-15.3)*
- *Day 4*
  - *Multiple Integrals (Chapter 15)*
    - *Double Integrals (15.1-15.3, continued)*
    - *Applications of Double Integrals (15.4)*
- *Day 5*
  - *Assignment 3 due*
  - *Multiple Integrals (Chapter 15)*
    - *Surface Area (15.5)*
    - *Triple Integrals (15.6-15.8)*

Week 4

- *Day 1*
  - *Multiple Integrals (Chapter 15)*
    - *Triple Integrals (15.6-15.8, continued)*
    - *Change of Variables in Multiple Integrals (15.9)*
- *Day 2*
  - *Vector Calculus (Chapter 16)*
    - *Vector Fields (16.1)*
    - *Line Integrals (16.2)*
- *Day 3*
  - *Vector Calculus (Chapter 16, continued)*
    - *The Fundamental Theorem for Line Integrals (16.3)*
    - *Green's Theorem (16.4)*
- *Day 4*
  - *Vector Calculus (Chapter 16, continued)*
    - *Green's Theorem (16.4)*
    - *Curl and Divergence (16.5)*
- *Day 5*
  - *Assignment 4 due*
  - *Vector Calculus (Chapter 16, continued)*
    - *Curl and Divergence (16.5)*

- ▪ *Parametric Surfaces and Their Areas (16.6)*

Week 5

- - *Day 1*
    - ○ *Vector Calculus (Chapter 16, continued)*
      - ▪ *Surface Integrals (16.7)*
- - *Day 2*
    - ○ *Vector Calculus (Chapter 16, continued)*
      - ▪ *Stoke's Theorem (16.8)*
      - ▪ *The Divergence Theorem (16.9)*
- - *Day 3*
    - ○ *Final review session*
- - *Day 4*
    - ○ *Final review session*
- - *Day 5*
    - ○ *Final exam*
    - ○ *Assignment 5 due*

Academic Honesty

Students are expected to maintain high standards of academic honesty. Specifically, unless otherwise directed by the professor, students may not consult other students, books, notes, electronic devices or any other source, on examinations. Failure to abide by this may result in a zero on the examination, or even failure in the course.