East China Normal University
International Summer Session

MAT 23 Multivariable Calculus

Term: July 5th –August 8th, 2018
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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: MAT 12 or equivalent 2nd semester calculus course

Course Overview

Calculus I and Calculus II (MAT 11 and MAT 12) deal with functions of only one variable, "x". Therefore in both Calculus I & II students are working in 2 dimensions, "x" and "y", where y = f(x). However we live in a 3-dimensional world, typically x-y-z. Calculus III (MAT 23) extends the calculus of 2 dimensions to three-dimensional space "xyz space." Happily, the mathematical techniques developed to extend calculus to 3-space generalize naturally to extending to problems with more than 3 variables, a multivariable calculus. MAT 23 considers this extension.

We will focus primarily on functions of two variables, z = f(x,y). These are 3 –dimensional surfaces. We will, for example, find tangent planes to surfaces (generalizing the process to find tangent lines to curves. Another topic we will discuss, involving principles familiar from single-variable calculus, is critical points and the role they play in solving optimization problems.

Course Goals:

A student who satisfactorily completes this course should:

1. Students should become comfortable working in three-dimensional space:
2. Work with rectangular, cylindrical, and spherical co-ordinate systems

3. Work with general coordinate transformations and apply them to change variables in double and triple integrals.
4. Feel confident working with vectors and the standard operations involving them such as the dot and cross product.
5. Compute partial derivatives of any of the functions encountered in Calc I & II with multiple variables.
6. Compute double and triple integrals
7. Solve simple optimization problems with multiple variables
8. Compute div, grad, curl of a vector function
9. Use Green's Theorem
10. Use Divergence Theorem
11. Use Stoke's Theorem

Required Text

Multivariable Calculus 8th edition
James Stewart

Publisher: Brooks Cole; 8 edition (June 15 2015)

ISBN-10: 1305266641
ISBN-13: 978-1305266643

Note: The 7th edition of this Stewart text is also acceptable

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 from July 5 to August 8. ECNU awards 4 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:

Mid-Term Test	25%
Assignments	25%
Final Exam	50%

Percentage Interval	Letter Grade
[90,100]	A
[85, 89]	A-
[80,84]	B+
[75,79]	B
[70,74]	B-
[65,69]	C+
[60,64]	C
[50,59]	D
Below 50	F

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. 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.
- Participate in class discussions and complete required written work on time.
- Refrain from texting, phoning or engaging in computer activities unrelated to class during class Students who do not do this will be asked to leave the class
- While class participation is welcome, even required, you are expected to refrain from private conversations during the class period.

Course Schedules

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 ONE July 5 6

Thurs Coordinate systems
Fri Vectors and vector operations, equations of lines and planes

WEEK TWO

Mon Cylinders and quadric surfaces
Tues Vector functions and space curves
Wed Arc-length and curvature
Thurs Functions of Several Variables, Limits & Continuity
Fri Partial derivatives, tangent planes and linear approximation

WEEK THREE

Mon Chain rule
Tues Directional derivatives and the gradient,
Wed Optimization
Thurs **Mid-Term Test 25%**
Fri Lagrange Multiplier

WEEK FOUR

Mon Double Integral over rectangles
Tues Double Integrals
Wed Application of Double Integrals, Surface Area
Thurs Triple integrals and their applications
Fri Change of variables in multiple integrals

WEEK FIVE

Mon Vector fields
Tues Line integrals, Green's Theorem,
Wed Curl and divergence
Thurs Parametric surfaces
Fri Surface integrals

WEEK SIX August 6，7 8

Mon Stokes' Theorem,
Tues Divergence Theorem,
Wed **Final Exam 50%**

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.