Math 2023 (lecture sessions 1 ,2 ,3) Multivariable Calculus

Course Outline – Fall Semester 2023

1. Course Instructor

Name: Dr. Hon-Ming HO

Contact Details: Room 3419, Phone 34693032, e-mail: mastanho@ust.hk

Office Hour: Tuesday from 12:00 pm to 2:00 pm

2. Teaching Assistant

Name: KONG, Hoi-Sang

Contact Details: Room 3010, e-mail: mahsk@ust.hk

Name: CHENG, Tommy Wing Cheong

Contact Details: Room 3012, e-mail: matcheng@ust.hk

3. Meeting Time and Venue

Lectures: L1: Monday, Wednesday, Friday 9:30 am- 10:20 am in Room 2306

Tutorial: T1a: Tuesday 13:30 - 14:20 LSK1027

Tutorial: T1b: Friday 11:00 – 11:50 Room 2406

Tutorial: T1c: Wednesday 18:00 – 18:50 Room LSK1034

Lectures: L2: Monday, Wednesday, Friday 10:30-11:20 in Room 2306

Tutorial: T2a: Thursday 18:00-18:50 Room LSK 1034

Tutorial: T2b: Monday 18:00–18:50 2503

Tutorial: T2c: Friday 9:00–9:50 Room 2406

Lectures: L3: Monday, Wednesday, Friday 1:30 pm-2:20 pm in 2306

Tutorial: T3a: Wednesday 18:00-18:50 Room LSK1010

Tutorial: T3b: Wednesday 12:00 –12:50 Room 2302

Tutorial: T3c: Monday 14:30 –15:20 Room 2306

4. Course Description

- Credit Points: 3 units
- Pre-requisite: A passing grade in AL Pure Mathematics / AL Applied Mathematics; OR MATH1014; OR MATH1020; OR MATH1024
- Exclusion: MATH2011
- Brief Information/Synopsis:
  Topics include Differentiation in several variables, with applications in approximation, maximum and minimum and geometry, Lagrange multipliers, integration in several variables, vector analysis, Green's theorem, Stoke's theorem, divergence theorem, change of variables.

5. Intended Learning Outcomes

Upon successful completion of this course, students should be able to do:

No.	ILOs
1	Develop an understanding of the core ideas and concepts and principles of limits, differentiation, and integration of functions in multiple variables, vector analysis.
2	Recognize the power of abstraction and generalization, carry out mathematical work with independent judgement,
3	Apply rigorous, analytical and numeric approach to analyze and solve problems using concepts of multivariable calculus,
4	Communicate problem solutions using correct mathematical terminology and good English.

6. Assessment Scheme

a) Examination duration: 90 minutes for mid-term exam, 3 hours for the final examination.

b) Percentage of coursework, examination

Assessment	Assessing Course ILOs
15% by online homework assignment	1, 2, 3, 4
30% by mid-term examination	1, 2, 3, 4
55% by final examination	1, 2, 3, 4

c) The grading is assigned based on students' performance in assessment tasks/activities.

7. Student Learning Resources

- *Lecture notes*: Lecture notes will be distributed on every lecture.
- ***Textbook*: Calculus Early Transcendentals by James Stewart, 9th edition, BROOKS/COLE CENGAGE Learning**
- *Math Support Center:* Learning support provided by Mathematics Department (http://www.math.ust.hk/~support)

8. Teaching and Learning Activities

Scheduled activities: 3 hours (lecture) + 1 hour (tutorial).

Lecture will focus on illustrating the concepts of the course content, while tutorials will focus on examples and problem skills.

9. Course Schedule

Week	Key Topics
1	Three-Dimensional space (section 12.1), Quadric Surfaces (section 12.6) , Vectors in the plane (section 12.2) , Vectors in three dimensions (section 12.2) ,Dot products (section 12.3)
2	Cross products (section 12.4), Lines and planes in 3-space (section 12.5)
3	Calculus I of vector-valued functions, Motion in space, Calculus II of vector-valued functions, Length of curves (section 13.1, 13.2, 13.3)
4	Functions of several variables, level curves, limits and continuity of functions of several variables, partial differentiation (section 14.1, 14.2, 14.3)
5	Differentiability of functions of several variables, Chain rules, directional derivatives and gradient vectors (section 14.5, 14.6)
6	Gradient vectors, Tangent planes and linear approximations, Maximum and Minimum values (section 14.4, 14.7)
7	Extreme values, Lagrange multipliers (section 14.7, 14.8)
8	Double integration on rectangular regions, double integration on general regions, polar coordinate system (section 15.1, 15.2, 15.3)
9	Double integrals in polar coordinate, surface area, triple integrals in rectangular coordinate system (section 15.4, 15.6, 15.7)
10	Triple integrals in cylindrical coordinate system (section 15.8), line integrals, vector fields and line integrals in vector fields (section 16.1, 16.2)
11	Flux of a vector field, path independence, potential functions and conservative vector fields and Green's theorem in the plane (section 16.3, 16.4, 16.5, 16.6)
12	Surface integrals, flux of a vector field across a surface (section 16.7)
13	Divergence theorem and Stoke's theorem (section 16.8, 16.9)