MATH 2023 – Multivariable Calculus

Spring 2021 Course Outline

Lecture

Instructor:	**Prof. IP, Ivan Chi-Ho**
Office:	Room 3483 (Lift 25-26)
Office Hour:	By appointment, or arrange a Zoom Meeting
E-mail:	ivan.ip@ust.hk

Tutorial

TA:	**Wong, Chun Wai**	**Tong, Kam Hung**
Office:	Room 4382 (Lift 17-18)	Room Room 4381 (Lift 17-18)
Office Hours:	By appointment, or arrange a Zoom Meeting	
E-mail:	cwwongaz@ust.hk	khtongad@connect.ust.hk

Meeting Time and Venue

Lecture:	Tuesday, Thursday 12:00 – 13:20	Zoom ID: 924 8104 0821	Ivan Ip
Session T1A:	Tuesday 18:00 – 18:50	Zoom ID: 934 0477 6544	Chun Wai, Wong
Session T1B:	Thursday 18:00 – 18:50	Zoom ID: 974 7069 2824	Kam Hung, Tong

Course Description

Lines, curves and planes in 3-dimensional space. Differentiations in several variables. Optimization problems and Lagrange multipliers. Integrations in several variables. Vector fields, curls and divergence operators. Green's, Stokes' and Divergence Theorem.

Prerequisite:	MATH1020 or MATH1014 or MATH1024; AL Applied Mathematics; or AL Pure Mathematics
Exclusion:	MATH2010, MATH2011, MATH2021
Credits:	4

Intended Learning Outcomes

Upon completion of this course, students are expected:

1. Develop an understanding of the core ideas and concepts of Multivariable Calculus.
2. Be able to recognize the power of abstraction and generalization, and to carry out mathematical work with independent judgment.
3. Be able to apply rigorous, analytic, and numeric approach to analyze and solve problems.
4. Be able to explain clearly concepts and calculations from Multivariable Calculus.

Assessment Scheme

	Weight	Assessment ILOs
WebWork	10%	1,2,3
Homework	5%	1,4
Midterm Examination	35%	1,2,3,4
Final Examination	50%	1,2,3,4

WebWork will be posted on the website http://webwork.math.ust.hk/webwork2 and is due every week. Homeworks are drawing exercises and are due bi-weekly.

Grading Scheme

Letter grades will be assigned depending on overall performance.
Obtaining a total point of 95% or above, or top 5%, will guarantee an A+.
Obtaining a total point of 75% or above will guarantee an A-range.
Obtaining a total point of 30% or above will guarantee a passing grade.

Teaching and Learning Activities

Aside from lectures, to master this course students are required to do as many exercises as they can to get familiar with the subject. There are several sets of problems available on canvas in which the students are recommended to complete. They are optional and will not be graded, but a substantial amount of the problems in both Midterm and Final Exams will be based on them.

- We will work through problems provided in Worksheet format during every lecture.
- Tutorial Problem Sets will be discussed during the Tutorial Session. Solutions are available after each tutorial.
- Additional Problem Sets are published from time to time. Students are encouraged to try them out and discuss among themselves. Selected solutions will be available 2 weeks before the corresponding Exams.

Student Learning Resources

Textbook: *Calculus Early Transcendentals (8th ed.)* by James Stewart (Ch 12–16)
Lecture Notes written by Prof. Frederick Tsz-Ho Fong (available on canvas).
Lecture Slides will also be available on canvas after class.

References: The multivariable calculus chapters of the following textbooks:

1. *Calculus for Scientists and Engineers* by Briggs, Cochran, Gillett
2. *Thomas' Calculus* by Thomas Weir
3. *Calculus of Several Variables* by Robert Adams

Tentative Schedule

Week 1	Review of Vectors in 3D, Cross Product, Dot Product, Lines and Planes
Week 2	Vector-valued Functions, Curves and Arc Length
Week 3	Multivariable Functions, Limits and Continuity, Partial Derivatives
Week 4	Tangent Planes, Linear Approximation, Chain Rules
Week 5	Directional Derivatives, Gradient Vector
Week 6	Optimization Problems, Lagrange Multipliers
Week 7	Double Integrals, Polar Coordinates, Surface Area
Week 8	Triple Integral, Cylindrical and Spherical Coordinates
Week 9(half)	Vector Fields, Conservative Fields
Week 10(half)	Line Integrals
Week 11	Green's Theorem, Curl and Divergence
Week 12	Parametric Surface, Surface Integral
Week 13	Stokes' Theorem, Divergence Theorem
Week 14	Einstein Summation Convention, Generalized Stokes' Theorem