Hong Kong Baptist University
Faculty of Science
Department of Mathematics

Title (Units): **MATH2150 MATHEMATICAL ANALYSIS III** (3,3,0)

Course Aims: This course deals with vectors calculus. It provides basic concept on several variables real-valued functions. Topics include sequences in space, limit and continuity, differentiation, Riemann integrals, multiple integrals, line integrals and surface integrals.

Prerequisite: MATH1111-2 MATHEMATICAL ANALYSIS I & II

(MATH 1120 Linear Algebra is not required but recommended)

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Learning Outcomes (LOs):

Upon successful completion of this course, students should be:

No.	Learning Outcomes (LOs)
	Knowledge
1	Able to explain some of the properties of continuous functions in two or more variables
2	Able to establish the rules for partial differential equations
3	Able to develop the concept about inverse and implicit functions
4	Able to establish the rules for integration of several variables functions
5	Able to understand Geometrical concepts in $\mathbb{R}^3$
6	Able to develop the concept about vector and scalar fields
7	Able to use MapleV and its instructions
8	Able to apply vector calculus in different applications
9	Able to evaluate line, surface and volume integrals in simple coordinate systems
	Skills
10	Able to use a change of variables to calculate multiple integrals
11	Able to employ divergence's Green's and Stokes' theorems to solve line and surface integrals
12	Able to calculate div, grad and curl in simple coordinate systems, and use identities connecting these quantities

Assessment:

No.	Assessment Methods	Weighting	Remarks
1	Continuous assessment	20%	Continuous Assessment is designed to measure how well the students have learned the basic concepts and fundamental theory of function of several variables and its integrations.
2	Midterm Examination	30%	Examination questions are designed to see how far students have achieved their intended learning outcomes. Questions will primarily be understanding and skills based to assess the student's versatility in solving problems in function of several variables and its integrations.
3	Final Examination	50%	

Learning Outcomes and Weighting:

Contents		LO No.	Teaching (in hours)
I	Vectors and Coordinate Geometry in 3-Space	5,7	3
II	Vector Functions and Curves	1,5,7	6
III	Partial Differentiation	2,3,7,10	9
IV	Applications of Partial Derivatives	7,8	3
V	Multiple Integration	4,7-9	6
VI	Vector Fields	6,7,9	6
VII	Vector Calculus	7,9,11,12	9

Textbook: R.A. Adams, Calculus, Several Variables, 6th Ed, Addison-Wesley, 2006.

References: P.M. Fitzpatrick, Advanced Calculus, PWS, 1996.

T.M. Apostol, Mathematical Analysis, 5th edition, Addison-Wesley, 1971.

J.R. Kirkwood, An Introduction to Analysis, PWS-KENT, 2nd edition, 1995.

Jonathan Lewin, An Introduction to Mathematical Analysis, 2nd edition, McGraw Hill, 1993.

R.A. Adams, Calculus, Single Variables, 6th Ed, Addison-Wesley, 2006.

Software: Maple V

Course Content in Outline:

	Topics	**Hours**
I.	Vectors and Coordinate Geometry in 3-Space A. Analytic Geometry in Three Dimensions B. The Cross Product in 3-Space C. Planes and Lines	3
II.	Vector Functions and Curves A. Vector Functions of One Variable B. Curves and Parametrizations C. Curvature, Torsion, and the Frenet Frame	6
III.	Partial Differentiation A. Functions of Several Variables B. Limits and Continuity C. Partial Derivatives D. Higher-Order Derivatives E. The Chain Rule F. Linear Approximations, Differentiability, and Differentials G. Gradients and Directional Derivatives H. Implicit Functions I. Taylor Series and Approximations	9
IV.	Applications of Partial Derivatives A. Extreme Values B. Extreme Values of Functions Defined on Restricted Domains C. Lagrange Multipliers D. The Method of Least Squares	3
V.	Multiple Integration A. Double Integrals B. Improper Integrals and a Mean-Value Theorem C. Double Integrals in Polar Coordinates D. Triple Integrals E. Change of Variables in Triple Integrals F. Applications of Multiple Integrals	6
VI.	Vector Fields A. Vector and Scalar Fields B. Conservative Fields C. Line Integrals D. Line Integrals of Vector Fields E. Surface and Surface Integrals F. Oriented Surfaces and Flux Integrals	6

VII. Vector Calculus 9

A. Gradient, Divergence, and Curl
B. Some Identities Involving Grad, Div, and Curl
C. Green's Theorem in the Plane
D. The Divergence Theorem in 3-Space
E. Stokes's Theorem