



Department of Mathematics, Faculty of Science

Khon Kaen University

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314423 FUNCTIONS OF SEVERAL REAL VARIABLES

(ฟังก์ชันของตัวแปรจริงหลายตัว)

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- **Course:** 314423: FUNCTIONS OF SEVERAL REAL VARIABLES
- **Instructor:** Dr.Nimit Nimana
- **Class Meeting Time:**

Monday	14.30 – 16.00	Room SC7305
Wednesday	14.30 – 16.00	Room SC7305
- **Credit:** 3 (3-0-6)
- **Prerequisite:**
  - 314211 LINEAR ALGEBRA I
  - 314221 ADVANCED CALCULUS
  - 314321 MATHEMATICAL ANALYSIS I
- **Course Description:**

Basic topology of  $\mathbb{R}^n$ , sequences in  $\mathbb{R}^n$ , limits and continuity, uniform continuity, differentiation, integration.
- **Topics:**
  - (1) The Real Line and Euclidean  $n$ -Space
    - The Real Number Line  $\mathbb{R}$
    - Euclidean  $n$ -Space  $\mathbb{R}^n$
  - (2) Topology of  $\mathbb{R}^n$ 
    - Open Sets
    - Interior of a Set
    - Closed Sets
    - Accumulation Points

- Closure of a Set
- Boundary of a Set
- Sequences
- Series of  $\mathbb{R}$  and  $\mathbb{R}^n$
- (3) Compact and Connected Sets
  - Compact sets: The Heine-Borel and Bolzano-Weierstrass Theorems
  - Nested Set Property
  - Path-Connected Sets
  - Connected Sets
- (4) Continuous Mappings
  - Continuity
  - Images of Compact and Connected Sets
  - Operations on Continuous Mappings
  - The Boundedness of Continuous Functions of Compact Sets
  - The Intermediate Value Theorem
  - Uniform Continuity
- (5) Uniform Convergence
  - Pointwise and Uniform Convergence
  - The Weierstrass  $M$ -Test
  - The Space of Continuous Functions
- (6) Differentiable Mappings
  - Definition of the Derivative
  - Matrix Representation
  - Continuity of Differentiable Mappings; Differentiable Paths
  - Conditions for Differentiability
  - The Chain Rule
  - Product Rule and Gradients
  - The Mean Value Theorem
  - Taylor's Theorem and Higher Derivatives
  - Maxima and Minima
- (7) The Inverse and Implicit Function Theorems and Related Topics
  - Inverse Function Theorem
  - Implicit Function Theorem
  - Constrained Extrema and Lagrange Multipliers
- (8) Integration
  - Integrable Functions
  - Volume and Sets of Measure Zero
  - Lebesgue's Theorem
  - Properties of the Integral
- (9) Fubini's Theorem
  - Fubini's Theorem
  - Change of Variables Theorem

- **Grading Policy:**

Problem sets	10 %
Presentations	25 %
Two midterm exams	40 % (20/20)
Final exam	25 %

- **Textbook:**

Any good book in advanced mathematical analysis and functional analysis should be useful. Our main reference will be:

Marsden, J. E.: (1974). Elementary Classical Analysis. San Francisco: W. H. Freeman and Company.

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