

Instruction for MTH 101 International Program
King Mongkut's University of Technology Thonburi (KMUTT)
Semester 1/2023

1. General Information

Course Title : MTH 101 Mathematics 1

Modules: MTH10101 Limit, Continuity and Derivatives (Module 1)
MTH10102 Integrals (Module 2)

Credits: MTH10101 2 credits, MTH10102 1 credits

Course Management

Course Instructors	Sections	Classroom	Email
Assoc.Prof.Dr.Pawaton Kaemawichanurat	34	CB2201 (Tue) CB2251 (Wed)	Pawaton.kae@kmutt.ac.th

2. Course Description

MTH10101 Limit, Continuity and Derivatives

Limits and Continuity : The concept of limit, Computation of limits, Limits involving infinity, Continuity, Limits and continuity of trigonometric functions

The Derivative : Slopes and rates of change, The derivative, The chain rule, Higher order derivatives, Derivatives of transcendental functions (Trigonometric, Inverse trigonometric, Logarithmic, Exponential, and Hyperbolic functions), Implicit differentiation, Differentials, Linear approximation, The mean value theorem

Applications of Differentiation : Maximum and minimum values, Applied maximum and minimum problems, Increasing and decreasing functions, Concavity and inflection points, Overview of curve sketching, Related rates, Indeterminate forms and L'Hopital's rule

Function of several variables : Graph of equation, Limit and continuity, Partial derivative, Differentials, Chain rule, Critical points , Second order partial derivative, Relative extrema, Maxima and minima, Saddle points

MTH10102 Integrals

Integration : Antiderivatives and indefinite integrals, The definite integrals, Average values and the fundamental theorem of calculus, Integration by substitution, Techniques of integration (Integration by parts, Integration of rational functions using partial fractions)

Applications of the Definite Integral : Area between curves

Improper Integrals : Improper integrals with infinite intervals of integration, Improper integrals with infinite discontinuities in the interval of integration, Improper integrals with infinite discontinuities over infinite intervals of integration

Numerical Integration : trapezoidal rule and Simpson's rule

3. Objectives

1. Solve problems and express mathematical ideas coherently in written form based on mathematical logic
2. Explain concepts in functions of one or more variables and calculate inverse functions, limits, derivatives, maxima and minima, and linear approximation
3. Explain concepts and how to use the theorems that apply specifically to continuous functions (intermediate value theorem, extreme value theorem) and to differentiable functions (chain rule, Rolle's theorem, mean value theorem, l'Hôpital's rule)
4. Explain the concepts of differential calculus of functions of two or more variables, continuity, partial differentiation, chain rule, Implicit differentiation
5. Find anti-derivatives by using standard techniques
6. Describe how the Fundamental Theorem of Calculus can be used both to evaluate integrals and to define new functions, and determine their basic properties
7. Apply calculus concepts in related rates, minimum and maximum problems, graph sketching, area, and volume

4. Schedule

Week	Topic	Module
1	Limit of Function, Computation of Limits	M1 (part 1)
2	Continuity of functions	
3	Basic Concepts of Derivative, Derivative of Algebraic Function, The chain Rule, Derivative of Transcendental Functions Derivative of Inverse Function	
4	Implicit Differentiation, Higher derivatives, Rolle’s Theorem and Mean-Value Theorem	
5	The Max-Min Value Theorem, Increasing and Decreasing Functions, Concavity, Using Derivative and limits in sketching Graph	
	Exam 1: M1 (part 1) Monday 11 September 2023	
6	Differentials, Linear Approximation , Indeterminate Form and L’Hopital’s Rule	M1 (part 2)
7	Applied Max-Min Problem, Related Rates	
8	Function of Several Variable, Graph of Equations	
9	Partial Derivative, Differentials, The Chain Rule	
10	Critical Points, Second Order Partial Derivative, Relative Extreme, Maxima, Minima and Saddle Points	

	Exam 2: M1 (part 2) Tuesday 24 October 2023	
11	Basic Concepts of Integrals, Fundamental Theorem of calculus	M2
12	Properties of Antiderivatives and Definite Integrals, Indefinite Integral, Integration by Substitution	
13	Integration By Parts Integration by Partial Fractions	
14	Areas under Curve and Areas between Curves	
15	Improper Integral, Numerical Integration	
	Exam 3: M2 Thursday 7 December 2023	

5. Teaching

- All the classes will be 100% onsite. Students must attend the classes by university rule. Please inform instructor in case of absence.
- Students should be able to use LEB2 which consists of video clips, exercises and all important information.
- Students are invited to join facebook group “MTH101 international 1/2023 KMUTT” or “<https://www.facebook.com/groups/268325992606513>” for updating any important announcement.

6. Evaluations

- To pass each module, students must reach at least level 3 of the rubric described below which is equivalent to grade C.

Grade	Scores (out of 100)
A (Rubric level 5)	80 and above
B+	70 – 79
B (Rubric level 4)	60 – 69
C+	50 – 59
C (Rubric level 3)	40 - 49
I	Below 40

***Time of the exams will be updated on Facebook**

***If there is any change, the notification will be promptly announced**

Remarks

- Students need to score at least 40% in each Module to pass (with grade C).
- For those students who obtain less than 40% on a module, they can retake the exam of that module (only one chance). The retake exam sessions will occur after exam 3. There will be a further announcement regarding this afterward.
- For each retake exam, those students who take it can obtain no more than 40% of that module. If students do not success on any retake exam, their grade on that module will be (I) and they will have to take that module again later.

7. OBEM Rubrics

OBEM Rubrics for Module 1

Level 1	No evidence
Level 2	Able to find limits of functions by simple methods such as table and graph. Able to find derivative of basic functions such as algebraic functions.
Level 3	Able to calculate limits and determine continuity of functions of one and several variables. Able to calculate derivatives of functions of one and several variables using chain rule and implicit differentiation. Able to identify the graph of two-variable functions. Able to relate the meaning of derivative to simple real situation.
Level 4	Able to logically explain and calculate limit and determine continuity of functions. Able to calculate, apply and relate the meaning to complex situations. Able to sketch the graph of one and two variables functions. Able to calculate partial derivatives of complicated functions. Able to apply mathematical concepts related to derivative to solve mathematical problems in science and engineering.
Level 5	Able to clearly explain the concept of derivatives, calculate, apply, and relate the meaning to complex situations. Able to clearly identify theorems behind the calculation. Able to clearly explain the concept of derivatives of functions of several variables. Able to calculate partial derivatives of complicated functions using derivative theorems showing precise calculation. Able to analyze the complex mathematical problems in science and engineering.

OBEM Rubrics for Module 2

Level 1	No evidence.
Level 2	Able to find anti-derivatives of basic functions such as polynomials, exponential and trigonometric functions.

Level 3	Able to use integration techniques to simple functions and apply it to find area between curves.
Level 4	Able to use integration techniques to more complicated functions. Able to classify improper integrals and determine the convergence of improper integrals. Able to apply numerical integration technique to approximate areas under curves.
Level 5	Able to evaluate integrals that require various integration techniques.

8. Communication Chanel

Students should use facebook group “MTH101 international 1/2023 KMUTT” or “<https://www.facebook.com/groups/268325992606513>” to contact teaching team and TAs as well as to receive all announcement.

9. Handouts

Students are able to download handouts from LEB2 or facebook group.

Students can further study from any calculus book that is provided at university library or website. The examples of calculus books are:

1. Anton, H., Bivens, I. and Davis, S., **Calculus**, Seventh Edition, John Wiley & Sons, New York, 2002.
2. Ayres, F. and Mendelson, E., **Calculus**, Third Edition, Schaum's Outline Series, McGraw-Hill, Singapore, 1992.
3. Edwards, C. H. and Penney, D. E., **Calculus with Analytic Geometry**, Fourth Edition, Prectice-Hall, New Jersey, 1994.
4. Finney, R. L., Weir, M. D. and Giordano, F. R., **Calculus**, Tenth Edition, Addison Wesley, New York, 2003.
5. Smith, R. T. and Minton, R. B., **Calculus**, Second Edition, McGraw-Hill, New York, 2002.
6. Swokowsky, E. W., **Calculus**, Fifth Edition, Pws-Kent Publishing Company, 1992.