

TKU211101

Single-Variable Calculus
Kalkulus Variabel Tunggal

BASIC INFORMATION

Course Credit	3 / 150 minutes per Week
Course Type	Required
Course Classification	Basic Science
Prerequisites	High School Level Algebra, Trigonometry and Calculus

STUDENT AND LEARNING OUTCOMES

Covered Student Outcomes

Fundamental and Engineering Knowledge (KP.1) Engineering Design (KP.3)
Development of Engineering Solution (KP.2)

Learning Outcomes

- LO1** Students are able to perform differentiation of a function with one variable.
- LO2** Students are able to perform integration of a function with one variable.
- LO3** Students are able to solve simple real-word problems using differential and integrals.

COURSE DESCRIPTION

Single-variable calculus is a fundamental course at Department of Electrical and Information Engineering (DTETI), which allows the students understand science and engineering. This course covers the differentiation and integration of a function with one variable.

TOPICS

1. Derivatives

- 1.1 Derivatives, slope, velocity, rate of change
- 1.2 Limits, continuity, Trigonometric limits
- 1.3 Derivatives of products, quotients, sine, cosine
- 1.4 Chain rule, Higher derivatives
- 1.5 Implicit differentiation, inverses
- 1.6 Exponential and log, Logarithmic differentiation; hyperbolic functions

2. Applications of Differentiation

- 2.1 Linear and quadratic approximations
- 2.2 Curve sketching
- 2.3 Max-min problems
- 2.4 Related rates
- 2.5 Newton's method and other applications
- 2.6 Mean value theorem, Inequalities

- 2.7 Differentials, antiderivatives
- 2.8 Differential equations, separation of variables

3. Integration

- 3.1 Definite integrals
- 3.2 First fundamental theorem of calculus
- 3.3 Second fundamental theorem
- 3.4 Applications to logarithms and geometry
- 3.5 Volumes by disks and shells
- 3.6 Work, average value, probability
- 3.7 Numerical integration

4. Techniques of Integration

- 4.1 Trigonometric integrals and substitution
- 4.2 Integration by inverse substitution; completing the square
- 4.3 Partial fractions
- 4.4 Integration by parts, reduction formulae
- 4.5 Parametric equations, arclength, surface area
- 4.6 Polar coordinates; area in polar coordinates
- 4.7 Indeterminate forms - L'Hôpital's rule
- 4.8 Improper integrals
- 4.9 Infinite series and convergence tests
- 4.10 Taylor's series

REFERENCES

- [1] MIT, Single-variable calculus, <https://ocw.mit.edu/courses/mathematics/18-01sc-single-variable-calculus-fall-2010/>
- [2] Thomas, G. B., 2001, Thomas' Calculus, Addison Wesley Publishing Company, New York