TKU211103

Multi-Variable Calculus

Kalkulus Variable Jamak

BASIC INFORMATION

Course Credit	3 / 150 minutes per Week
Course Type	Required
Course Classification	Basic Science
Prerequisites	Single-Variable Calculus

STUDENT AND LEARNING OUTCOMES

Covered Student Outcomes

Fundamental and Engineering Knowledge (KP.1)

Development of Engineering Solution (KP.2)

Engineering Design (KP.3)

Learning Outcomes

LO1 Students are able to perform differentiation of a function with more than one variable.

LO2 Students are able to perform integration of a function with more than one variable.

LO3 Students are able to vector calculus of a function with more than one variable.

LO4 Students are able to solve simple real-word problems using differential and integral.

COURSE DESCRIPTION

This course deals with differential, integral, and vector calculus for functions with more than one variables. The materials in this course are closely related to problems partinent to science and engineering.

TOPICS

1. Vectors and matrices

1.1 Vectors
1.2 Dot product
1.3 Determinants; cross product
1.4 Matrices; inverse matrices
1.5 Square systems; equations of planes
1.6 Parametric equations for lines and curves
1.7 Velocity, acceleration
1.8 Kepler's second law

2. Partial derivatives

2.1 Level curves; partial derivatives; tangent plane approximation
2.2 Max-min problems; least squares
2.3 Second derivative test; boundaries and infinity

2.4 Differentials; chain rule
2.5 Gradient; directional derivative; tangent plane
2.6 Lagrange multipliers
2.7 Non-independent variables
2.8 Partial differential equations; review

3. Double integrals and line integrals in the plane
3.1 Double integrals
3.2 Double integrals in polar coordinates; applications
3.3 Change of variables
3.4 Vector fields and line integrals in the plane
3.5 Path independence and conservative fields
3.6 Gradient fields and potential functions
3.7 Green's theorem
3.8 Flux; normal form of Green's theorem
3.9 Simply connected regions; review

4. Triple integrals and surface integrals in 3-space
4.1 Triple integrals in rectangular and cylindrical coordinates
4.2 Spherical coordinates; surface area
4.3 Vector fields in 3D; surface integrals and flux
4.4 Divergence theorem
4.5 Divergence theorem (cont.): applications and proof
4.6 Line integrals in space, curl, exactness and potentials
4.7 Stokes' theorem
4.8 Stokes' theorem (cont.); review
4.9 Topological considerations
4.10 Maxwell's equations

REFERENCES

[1] MIT., Multi-variable calculus., https://ocw.mit.edu/courses/mathematics/18-02sc-multivariable-calculus-fall-2010/
[2] Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley & Sons, 1988