

TKU211201

Complex Variable Analysis

Analisa Variable Kompleks

BASIC INFORMATION

Course Credit	3 / 150 minutes per Week
Course Type	Required
Course Classification	Basic Science
Prerequisites	Multi-Variable 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 understand the complex number and basic operations, and analytic functions.
- LO2** Students are able to perform integration on complex functions using Cauchy's Theorem and Cauchy's integral formula.
- LO3** Students are able to identify the existence of Taylor and Laurent series of an analytic functions.
- LO4** Students are able to understand Fourier series and Fourier transform.

COURSE DESCRIPTION

Complex analysis is a fundamental in developing solution to many practical problems. It discusses the calculus of complex functions with the main results around Cauchy's Theorem, Cauchy's integral formula, and the existence of Taylor and Laurent series. In the last part of the course, students will also learn the application of complex analysis, namely Fourier series and Fourier transform.

TOPICS

1. Pengantar Bilangan Kompleks beserta Operasi-Operasi Dasar

- 1.1 Penjumlahan
- 1.2 Pengurangan
- 1.3 Konjugasi
- 1.4 Triangle Inequality
- 1.5 Akar Bilangan Kompleks
- 1.6 Area dalam Bidang Kompleks

2. Fungsi Analitik

- 2.1 Fungsi dan Pemetaan
- 2.2 Teorema Limit
- 2.3 Kontinuitas
- 2.4 Turunan dan Differensial Peubah Kompleks
- 2.5 Kondisi-Kondisi dalam Operasi Differensial
- 2.6 Persamaan Cauchy Riemann
- 2.7 Koordinat Polar
- 2.8 Fungsi Analitik
- 2.9 Fungsi Harmonik

3. Fungsi Elementer

- 3.1 Fungsi Eksponensial
- 3.2 Fungsi Logaritma
- 3.3 Fungsi Trigonometrik
- 3.4 Fungsi Hiperbolik

4. Integral Kompleks

- 4.1 Definite Integral
- 4.2 Kontur dan Integral Kontur

4.3 Branch Cuts

4.4 Anti Derivatives

4.5 Theorema Cauchy-Goursat

4.6 Connected-Domains

4.7 Formula Integral Cauchy

5. Deret

5.1 Barisan, Deret dan Konvergensinya

5.2 Deret Taylor

5.3 Deret Laurent

5.4 Konvergensi Deret Pangkat

5.5 Kontinuitas Deret Pangkat

5.6 Integrasi dan Differensiasi Deret Pangkat

5.7 Perkalian dan Pembagian Deret Pangkat

6. Teorema Residu

6.1 Residu

6.2 Teorema Residu Cauchy

6.3 Residues at Poles

6.4 Zeros of Analytic Functions

6.5 Zeros and Poles

7. Pengantar Isyarat.

7.1 Isyarat Diskret dan Isyarat Kontinu

7.2 Isyarat Impuls Satuan dan Undak Satuan

7.3 Variabel bebas dan Transformasinya

7.4 Isyarat Periodik

7.5 Isyarat Ganjil dan Genap

8. Deret Fourier untuk Isyarat Kontinu

8.1 Pengantar Deret Fourier dan Isyarat Periodik

8.2 Dekomposisi Isyarat Periodik dalam Basis Fungsi Sinusoidal

8.3 Dekomposisi Isyarat Periodik dalam Basis Fungsi Complex Exponential

8.4 Kondisi Dirichlet

8.5 Sifat-Sifat Deret Fourier

9. Transformasi Fourier untuk Isyarat Kontinu

9.1 Transformasi Fourier untuk Isyarat Aperiodik

9.2 Transformasi Fourier untuk Isyarat Periodik

9.3 Kondisi untuk Transformasi Fourier

9.4 Sifat-Sifat Transformasi Fourier (tidak termasuk perkalian dan konvolusi)

REFERENCES

- [1] Brown, James Ward and Ruel V. Churchill. Complex Variables and Applications. 9th ed. McGraw-Hill Education, 2013. ISBN: 9780073383170.