Minnesota State University Moorhead

MATH 661: Functions of Complex Variables and Applications

A. COURSE DESCRIPTION

Credits: 3

Lecture Hours/Week: 3

Lab Hours/Week: 0

OJT Hours/Week: *.*

Prerequisites: None

Corequisites: None

MnTC Goals: None

The field of complex numbers is an extension of the field of real numbers. Complex numbers and the function of complex variables have application in many branches of mathematics, including algebraic geometry, number theory, analytic combinatorics, applied mathematics; as well as in physics, including the branches of hydrodynamics, thermodynamics, and particularly quantum mechanics. In this course, we will study complex numbers, arithmetic of complex numbers, function of complex variables, limit, continuity, differentiation, integration of functions of complex variables and some important theorems on differentiation and integration, convergence of series, types of series, residues, poles, conformal mappings, and finally their applications.

B. COURSE EFFECTIVE DATES: 12/01/2019 - Present

C. OUTLINE OF MAJOR CONTENT AREAS

1. Complex numbers, arithmetic and algebra on complex numbers, and geometric representation
2. Complex variable equations, root findings, DeMoivre's theorem, and basic topology of sets in the plane
3. Function of complex variables, elementary functions, and mappings
4. Limit, continuity, differentiation and integration of functions of complex variables
5. Differentiability, analytic functions, harmonic functions, Cauchy integral formulas
6. Fundamental theorem of algebra, Liouvill¿e theorem, and Maximum Modulus Principle
7. Sequences, series, Taylor and Laurent series
8. Residues, poles, and conformal mappings
9. Application: Harmonic oscillator, Fourier series and Fourier transform, conformal mappings on two-dimensional fluid flow, steady state temperature

D. LEARNING OUTCOMES (General)

1. Understand the complex numbers, their arithmetic, algebra and geometry.
2. Understand complex variables equations, functions of complex variables, mapping, and isomorphism between R2 and C.
3. Understand and compute limits, derivatives and integrals of the functions of complex variables.
4. Learn analytic functions and their properties, harmonic functions, and the proof of important theorems on differentiation.
5. Learn the proof of important theorems in integration.
6. Learn the power series some important series in complex analysis.
7. Learn the concept of residues and poles, conformal mappings.
8. Learn the application of complex number, functions of complex variables in wide variety of disciplines.

E. Minnesota Transfer Curriculum Goal Area(s) and Competencies

None

F. LEARNER OUTCOMES ASSESSMENT

As noted on course syllabus

G. SPECIAL INFORMATION

None noted