

Faculty of Engineering & Technology
Complex Variable and Special Functions (Math 5)

Information :

Course Code : MTH 311 **Level :** Undergraduate **Course Hours :** 3.00- Hours

Department : Department of Mechanical Engineering

Instructor Information :

Title	Name	Office hours
Lecturer	Ahmed Mahsoud Mohamed ElHadidi	2
Assistant Lecturer	TAREK ALI ABDALLAH TEAMA	
Teaching Assistant	Bassel Yasser Mohamed Kamel	

Area Of Study :

Demonstrate a conscious understanding of the concepts of special functions and complex analysis.
Develop students' mathematical skills for the methods of solution of partial differential equations.
Acquire skills for the application of special functions and complex analysis to solve electrical engineering problems

Description :

Power Series solutions of ordinary Differential equations. Solutions about Ordinary Points, Solutions about Singular Points. Frobenius theorem. Special functions, Partial differential equations, heat and wave equations. Laplace equation in Rectangular and Polar coordinates, D'Alembert solution, Numerical solutions of Partial differential equations. Functions of complex variables, Cauchy-Riemann Equations, Complex integrals, Laurent series, Evaluation of real integrals by residues. Conformal mappings.

Course outcomes :

a. Knowledge and Understanding: :

1 -	Define Elementary complex functions, Cauchy-Riemann Equations, Complex integrals, Laurent series, and the evaluation of real integrals by residues.
2 -	Describe conformal mappings for electrical engineering applications
3 -	Explain the Power Series solutions of ordinary Differential Solutions using Frobenius theorem
4 -	Identify Partial differential equations, their types and methods of solutions.
5 -	Define Gamma, Beta, and Bessel functions, and Legendre Polynomials as solutions of partial differential equations.

b. Intellectual Skills: :

1 -	Apply Special functions, power series solutions to solve engineering problems.
2 -	Apply numerical solutions of P.D.E to solve the Wave equation.
3 -	Solve improper integrals converted to Gamma and Beta functions.
4 -	Apply Cauchy-Riemann Equations, Laurent series, and residues theorem for the solution of complex engineering problems.
5 -	Create conformal mapping procedures for the solution of complex functions problems.

c. Professional and Practical Skills: :

1 -	Use special functions to represent the Electromagnetic problems.
2 -	Apply Complex functions theorems to solve mechanical engineering problems.

d. General and Transferable Skills: :

1 -	Communicate effectively.
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Course Topic And Contents :

Topic	No. of hours	Lecture	Tutorial / Practical
Power Series solutions of ordinary Differential equations.	5	3	2
Frobenius Theorem	5	3	2
Special functions , Gamma , Beta , Bessel functions	5	3	2
Legendre Polynomial	5	3	2
Partial differential equations, Definitions and Classification of equations.	5	3	2
Separable Partial differential equations, heat equation, Wave equation	5	3	2
D'Alembert solution of wave equation	5	3	2
Laplace equation in Rectangular and Polar coordinates	5	3	2
Numerical solutions of Partial differential equations, Finite difference method	10	6	4
Functions of complex variables, Elementary complex functions	5	3	2
Cauchy-Riemann Equations	5	3	2
Complex integrals, Laurent series	5	3	2
Evaluation of real integrals by residues	5	3	2
Conformal mappings	5	3	2

Teaching And Learning Methodologies :

Interactive Lecture
Problem-based Learning
Discussion
Report

Course Assessment :

Methods of assessment	Relative weight %	Week No	Assess What
Assignment	5.00		
Final exam	40.00	16	
lab. Computer	5.00		To assess overall understandings, concepts, Knowledge, Problem solving, and mathematical skills delivered by the course

Mid- Exam 1I	25.00	10	To assess comprehension, Knowledge, Problem solving, and mathematical skills delivered by the course after 6 weeks of studying
Mid- Exam I	15.00	5	To assess the levels of math skills needed for successful completion of the course, and to improve teaching and learning for all students
Quizzes	10.00		

Recommended books :

Erwin Kreyszig. "Advanced Engineering Mathematics", 10th edition, John Wiley & Sons, INC, 2010.

Robert T. Smith, Roland B Minton. Calculus: Early Transcendental Functions. 4th. edition. McGraw . HILL International Edition, 2012