FORMAN CHRISTIAN COLLEGE, LAHORE

(A Chartered University)

Course Outline for Spring 2023

Instructor Information:

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Office Hours:

Monday, Wednesday, Friday : 9:00 AM – 10:00 AM

11:00 AM – 11:50 AM

Course Information:

Title: Complex Analysis
Course Code: MATH 307 (A)
Credit Hours: 4
Lectures Time: TR: 2:00-3:40 PM (S-412)
Prerequisite: Math 201

Recommended Books:

1. A First Course in Complex Analysis with applications, Dennis Zill & Patrick Shanahan
2. Krishna's Textbook on Complex Analysis, A. R. Vasishtha & A. K. Vasishtha
3. Lecture notes (Compiled by Dr. Wasiq Hussain, Professor Dept. of Mathematics, FCCU) [To be uploaded on Moodle]

Contents and learning Outcomes:

1. **Complex arithmetic, algebra and geometry:** Develop facility with complex numbers and the geometry of the complex plane culminating or applying in finding the nth roots of a complex number.
2. **Differentiable Functions and the Cauchy-Riemann equations:** Show knowledge of whether a complex function is differentiable and use the Cauchy-Riemann equations to calculate the derivative.
3. **Analytic and Harmonic functions:** Determine if a function is harmonic and find a harmonic conjugate via the Cauchy-Riemann equations.
4. **Sequences, Series and Power Series:** Determine whether a complex series converges. Should know the proofs of different tests used for checking convergence/divergence of complex series. Show understanding of the region of convergence for power series.
5. **Elementary functions – exponential and logarithm:** Understand the similarities and differences between the real and complex exponential function. Compute the complex logarithm.
6. **Elementary functions – trigonometric and hyperbolic:** Understand the relationships among the exponential, trigonometric and hyperbolic functions. Derive simple identities.
7. **Complex integration – contour integrals:** Set up and directly evaluate contour integrals and applications of residues to compute real integrals

Course Policies:

- Students must arrive at class on time, should remain in class for the entire class period and mobile phone should be switched off or on silence. Students failing to maintain at least 70% attendance will not be allowed to appear for Final Exam.
- Course assessment will be through **quizzes, attendance, assignments, midterm and final exam**.
- There will be **no make up** for the missed quizzes and assignments. There will be 4 Quizzes and best 3 will be considered while making aggregate. Make up of midterm and final exam is possible only under extremes cases (only if verified through Mercy Health Center). In case of make-up exam there will be a 0-20% deduction in marks depending upon case to case basis.
- Academic dishonesty or cheating will result in zero points (grade F) and will be referred to AIC (Academic Integrity Committee) at FCC.

Course Evaluation

Assignments	10%
Attendance/Class participation	5%
Quizzes	15%
Midterm Exam	30%
Final Exam	40%

GRADING SCALE

Grades	Quality Points	Numerical Value	Meaning
A	4.00	93-100	Superior
A-	3.70	90-92	
B+	3.30	87-89	
B	3.00	83-86	Good
B-	2.70	80-82	Fair
C+	2.30	77-79	
C	2.00	73-76	Satisfactory
C-	1.70	70-72	
D+	1.30	67-69	
D	1.00	60-66	Passing
F	0.00	59 or below	Failing

Course Outline

Week	Topics	Assessment
1	Algebraic and geometric properties of complex numbers	
2	Polar form of complex numbers, De Moivre's Formula, Roots of complex numbers	
3	Functions of complex variables, Limits & Continuity	
4	Limits and continuity (continued)	**Quiz 1**
5	Differentiability of functions of complex variables, The Cauchy-Riemann equations	
6	Analytic and Harmonic functions, The exponential & logarithmic functions of complex variables	**ASSIGNMENT 1**
7	Trigonometric, hyperbolic and their inverse functions	**Quiz 2**
8	Sequences of complex numbers and their convergence	
9	Series of complex numbers and their convergence	**Midterm Exam**
10	Power series, Radius of convergence	
11	Complex Integration and Contour Integrals	
12	Cauchy Goursat theorem	
13	Cauchy Integral formula and its extension for derivatives	**Quiz 3**
14	Taylor's and Laurent's series representation	
15	Singularities of complex functions and their types	**ASSIGNMENT 2**
16	Poles and Residues	**Quiz 4**
17	Cauchy Residue Theorem	