Department of Liberal Education
Era University, Lucknow
Course Outline
Effective From: 2023-24

Name of the Program	**B.A. / B.Sc. (LIBERAL EDUCATION)**			**Year/ Semester:**	**3rd / 6th**
Course Name	**Complex Analysis**	**Course Code:**	**MT305**	**Type:**	**Theory**
Credits	**04**			**Total Sessions Hours:**	**60 Hours**
Evaluation Spread	**Internal Continuous Assesment:**	**50 Marks**		**End Term Exam:**	**50 Marks**
Type of Course	○ Compulsory	◉ Core		○ Creative	○ Life Skill
Course Objectives	1. The objective of this course is to introduce the fundamental ideas of the functions of complex variables and developing a clear understanding of the fundamental concepts of complex analysis such as analytic functions, complex integrals and a range of skills which will allow students to work effectively with the concepts. 2. Understand how complex numbers provide a satisfying extension of the real numbers. 3. Learn techniques of complex analysis that make practical problems easy (e.g. graphical rotation and scaling as an example of complex multiplication); 4. Appreciate how mathematics is used in design (e.g. conformal mapping).				
Course Outcomes (CO): *After the successful course completion, learners will develop following attributes:*					
Course Outcome (CO)	**Attributes**				
CO1	Students will be able to understand the concept of analytical function and harmonic function.				
CO2	Student will be introduced to the concept of differentiability of power series and uses.				
CO3	Student will have a working knowledge of differentiability for complex functions and be familiar with the Cauchy-Riemann equations.				
CO4	Student will evaluate integrals along a path in the complex plane and understand the statement of Cauchy's Theorem.				
Pedagogy	Interactive, discussion-bases, student-centered, presentation.				
Internal Evaluation Mode	Mid-term Examination: 20 Marks Activity: 10 Marks Class test: 05 Marks Online Test/Objective Test: 05 Marks Assignments/Presentation: 05 Marks Attendance: 05 Marks				
Session Details	**Topic**			**Hours**	**Mapped CO**
Unit 1	Complex function and their limit, continuity, differentiability. Analytic functions, Cauchy Riemann equations, Necessary and sufficient condition, Harmonic function, velocity potential, Milne's Thomson method, Cauchy integral theorem, Cauchy's integral formula. **Activity:** Demonstrate about analytic fucntion though chart.			15	CO1

Unit 2	Power series, uniform convergence of power series, Taylor's and Laurent series, singular point and its classifications, zeros and poles, integration and differentiation of power series, multiplication and division of power series. **Activity:** Draw the process to find the zeros of analytic function on chart.	15	CO2
Unit 3	Residues, Calculation of residues, Cauchy Residue theorem, evaluation of the real definite integral: round the unit circle, evaluation of $\int_{-\infty}^{\infty} f(z)\,dz$ when *f(z)* has no pole on real axis and when pole lies on real axis. Evaluation of integral involving many valued functions, rectangular contours. **Activity:** Assignment based on activity for Cauchy Residue theorem.	15	CO3
Unit 4	Introduction to conformal transformation, bilinear transformation, Exponential transformation, trigonometric transformation, Special transformation, Schwarz-Christoffel transformation. **Activity:** Draw the process of bilinear transformation on chart.	15	CO4

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	1		1				1	2					1
CO2	1			1				1		1				1
CO3	1			1			1	1			2			1
CO4	1			1				1				1		1

Strong contribution-3, Average contribution-2 , Low contribution-1,

Suggested Readings:

Text- Books	Chaudhary, B., (1993). The elements of complex analysis. New York: J. Wiley.
Reference Books	1. Narayan, S. and Mittal P. K., (2016). Theory of functions of a complex variable. Delhi: S. Chand and Company Ltd. 2. Gameelin, T.W., Complex Analysis. 3. R. V. Churchill and J. W. Brown: Complex Variables and Applications, New York McGraw Hill, 9th Ed, 2013.
Para Text	**Unit 1:** 1. https://www.youtube.com/watch?v=t9xW7UaZwZ0 2. https://www.youtube.com/watch?v=CCMnwZHcW6w 3. https://www.youtube.com/watch?v=AsqDHj501Q8 4. https://www.youtube.com/watch?v=fSoQxuVdKIs **Unit 2:** 1. https://www.youtube.com/watch?v=xls_5Ly7VA4 2. https://www.youtube.com/watch?v=gUmIrJRXDSs **Unit 3:** 1. https://www.youtube.com/watch?v=xaKTNENeJdA 2. https://www.youtube.com/watch?v=enF9OuOC9MA 3. https://www.youtube.com/watch?v=E767TaIRRW8 **Unit 4:** 1. https://www.youtube.com/watch?v=xgnQTqMc6A4 2. https://www.youtube.com/watch?v=zv46WEGQi8M

Recapitulation & Examination Pattern		
Internal Continuous Assesment:		
Component	**Marks**	**Pattern**
Mid Semester	20	**Section A:** Contains **10** MCQs/Fill in the blanks/One Word Answer/ True-False type of questions. Each question carries **0.5 mark.** **Section B:** Contains **07** descriptive questions out of which **05** questions are to be attempted. Each question carries **03 marks**.
Activity	10	Will be decided by subject teacher
Class Test	05	Contains **05 descriptive questions.** Each question carries **01** mark.
Online Test/ Objective Test	05	Contains **10 multiple choice questions.** Each question carries **0.5** mark.
Assignment/ Presentation	05	Assignment to be made on topics and instruction given by subject teacher.
Attendance	05	As per policy
Total Marks	**50**	

Course created by: **Dr. Sheeba Rizvi**

Dr. Toukeer Khan

Signature:

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Signature: