Teaching Schedule

Course Objectives: In this course students will learn the algebra and geometry of complex numbers, mappings in the complex plane, the theory of multi-valued functions, and the calculus of functions of single complex variable. To analyses the complex number system and classify mathematical operations, analyses and problems involving complex numbers.

Course Outcomes: Upon completion of the course, students shall be able to

CO1: Perform basic mathematical operations (arithmetic, powers, roots) with complex numbers in Cartesian and polar forms

CO2: Determine continuity/differentiability/analyticity of a function and find the derivative of a function.

CO3: Work with functions (polynomials, reciprocals, exponential, trigonometric, hyperbolic, etc) of single complex variable and describe mappings in the complex plane.

CO4: Evaluate a contour integral using parametrization, fundamental theorem of calculus and cauchy's integral formula.

CO5: Find the taylor series of a function and determine its circle or annulus of convergence.

CO6: Compute the residue of a function and use the residue theory to evaluate a contour integral or an integral over the real line.

Semester : V | **Integrated M.Sc. Mathematics (060090501) CC11 Complex Analysis** | **Academic Year-2019-20**

Unit	Sub Unit	No. of Lect. (s)	Topics	Reference Chapter/ Additional Reading	Teaching Methodology to be used	Active Learning Activities	Evaluation Parameters
Unit 1: Functions Of Complex Variable							**[17]**
1	1.1	2	Limit, continuity, differentiability	Ch#1 Foundations of Complex Analysis S.Ponnusamy	Chalk & Talk	**For Slow Learner:** Students must write answer of question(s) given by teacher after completion of Unit. **For Active Learner:** Students read at least one research paper based on DIP and mapping content with Unit	Unit test
	1.2	3	Analytic function				
	1.3	4	Cauchy- Riemann equation				
	1.4	4	Construction of analytic function				
	1.5	4	Harmonic function				
Unit 2: Complex Integration							**[15]**
2	2.1	5	Cauchy's theorem, Cauchy's integral formula, Cauchy's inequalities	Ch#2 Foundations of Complex Analysis S.Ponnusamy	Chalk & Talk	**For Slow Learner:** Study methods from book/papers and discuss within group. ***For Active Learner:** Apply different methods in selected application and show the results with analysis.	Unit test
	2.2	5	Morera's theorem, Liouville's theorem. Taylor's and Laurent's series Maximum modulus principle				
	2.3	5	Singularities: Isolated, essential and removable. Zeroes and poles				
Unit 3: Residues							**[17]**
	3.1	2	Residue at pole, residue at infinity	Ch#3 Foundations of	Chalk	**For Slow Learner**: Study methods from book/papers	Assignment
	3.2	3	Cauchy's residue theorem				

3	3.3	4	Number of poles and zeroes of an analytic function	Complex Analysis S. Ponnusamy	& Talk	and discuss within group. *For Active Learner: Apply different methods in selected application and show the results with analysis.	
	3.4	4	Rouche's theorem				
	3.5	4	Contour integration: evaluation of integrals				
Unit 4: Conformal Mapping							**[16]**
4	4.1	2	Mobius transformation	Ch#4 Foundations of Complex Analysis S. Ponnusamy	Chalk & Talk	For Slow Learner: Provide calculation based question by teacher and Students solve them. *For Active Learner: Apply different methods in selected application and show the results with analysis	Assignment
	4.2	2	Translation				
	4.3	3	Rotation				
	4.4	3	Inversion				
	4.5	3	Cross-ratio				
	4.6	3	Critical value of a transformation				

Text books:

1. S. Ponnusamy, "Foundations of Complex Analysis", 2nd Edition, Narosa Book Distributors Pvt Ltd- New Delhi, 2017

Reference books:

1. Ruel V. Churchill, James Ward Brown, "Complex Variables and Applications", 8th Edition, Tata McGraw
   - Hill Education, 2009.
2. Narayan Shanti, "Theory of Functions of a Complex Variable", 2nd Edition, S. Chand & Company Pvt. Ltd

Course Objectives and Course Outcomes Mapping:

- learn the algebra and geometry of complex numbers, mappings in the complex plane, the theory of multi-valued functions, the calculus of functions of single complex variable - CO1, CO2, CO3

- To analyse the complex number system and classify mathematical operations, analyses and problems involving complex numbers - CO4, CO5, CO6

Course Units and Course Outcomes Mapping:

Unit No.	Unit	Course Outcomes					
		CO1	CO2	CO3	CO4	CO5	CO6
1	Functions of complex variable	√	√				
2	Complex Integration				√	√	
3	Residues						√
4	Conformal mapping			√			

Programme Outcomes (PO)

PO1: Knowledge

Provides knowledge about the fundamentals of pure, applied and computing mathematics and its applications to students that creates the opportunities in industries and research centers.

PO2: Core Competence

Creates competency in science and mathematics to formulate, analyses and solve problem and/or also to pursue advanced study or research.

PO3: Breadth

Trains students having good knowledge in unearth core of academia and industry by the roots of mathematics.

PO4: Evaluation

Imparts in students to raise trial and error-based curiosity and problem-solving functionality with research based advanced tutorial for higher level decision makings tools.

Programme Outcomes and Course Outcomes Mapping:

Programme Outcomes	Course Outcomes					
	CO1	CO2	CO3	CO4	CO5	CO6
PO1	✓	✓				
PO2		✓			✓	
PO3			✓			✓
PO4		✓		✓		