Session: 2026-27			
Part A – Introduction			
Subject	Mathematics		
Semester	VI		
Name of the Course	Mathematical Analysis		
Course Code	CC-A6		
Course ID	240/MATP/CC601		
Course Type: (CC/MIC/ MDC/ /VOC/AEC/VA C/SEC)	CC		
Course Learning Outcomes(CLOs)	After completing this course, the learner will be able to: 1. Recall fundamentals of metric, definition and basic idea of metric. 2. Discuss and analyze the continuity and its further properties. 3. To be familiar with complex numbers and their geometrical interpretation. 4. Understand the concept of complex numbers, various mappings and the some important theorems.		
Credits	**Theory**	**Practical**	**Total**
	3	1	4
Contact Hours	3	2	5
Internal Assessment Marks	25	5	30
End Term Assessment Marks	50	20	70

Examination Time	3 Hours	---	100

Part B - Course Content

Instructions for Paper- Setter Note: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking Course Learning Outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will contain 5 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question.

Unit	Topic	Contact Hours
I	Metric spaces: definition and examples, discrete metric, usual metric on $\mathbb{R}$ and $\mathbb{R}^n$, open and closed balls, neighbourhoods, open and closed sets, interior, limit and boundary points. closure and derived sets, dense sets and subspaces of a metric space.	**45 hrs**
II	Sequences and continuity in metric spaces, convergent sequences and their properties, bounded and Cauchy sequences, subsequence's, complete metric spaces, continuous functions between metric spaces, sequential and uniform continuity, basic ideas of homeomorphism and isometry.	
III	Extended Complex Plain, Stereographic projection, function of a complex variable, Continuity, Differentiability, Analytic functions and their properties, Cauchy Riemann equations in Cartesian and polar coordinates, Power series, Radius of convergence.	
IV	Mapping by elementary function: Translation, rotation, Magnification and inversion. Conformal Mapping and application, Mobius transformations, Fixed points, Cross ratio, Inverse points and critical mappings.	

Practical

The practical component of the course has two parts **(A) Problem Solving- Questions related to the following problems will be solved and their record will be maintained in the Practical Notebook:** 1. Problems of determining whether a given function is a metric or not? 2. Problems of proving that a given function is not a metric. 3. Problems of establishing a relationship between a metric space and Hausdorff	**30 hrs**

space.

4. Problem of establishing a relationship between a convergent sequence and Cauchy sequence in a metric space.
5. Problem of finding examples of a Cauchy sequence which is not convergent in Q.
6. Problem pertaining to continuity and differentiability of a complex function.
7. Problem pertaining to analytic functions.
8. Problem pertaining to radius of convergence.
9. Problem of translation and rotation function.
10. Problem pertaining to Mobius transformation.

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(B)The following practicals will be done using MAXIMA software and their record will be maintained in the practical note book:

1. Learn to run a program to compute distance between two points using Euclidean
2. Learn to run a program to verify metric axioms for a given function numerically.
3. Learn to run a program to compute distance between two points using Euclidean
4. Learn to run a program to find diameter of a finite set.
5. Learn to run a program check Cauchy sequence numerically.
6. Learn to run a program to plot complex numbers on Argand plane.
7. Learn to run a program to compute modulus and argument of a complex number.
8. Learn to run a program to visualize translation and rotation.
9. Learn to run a program to visualize inversion.
10. Learn to run a program to study mobius transformation.
11. Learn to run a program to visualize stereographic projection (sphere over complex plane)
12. Learn to run a program to plot image of lines/circles under complex transformations.

Suggested Evaluation Methods

Internal Assessment:

➢ **Theory 25**

- Class Participation: 5
- Seminar/presentation/assignment/quiz/class test etc.: 10
- Mid-Term Exam: 10

➢ **Practicum 5**

- Seminar/Demonstration/Viva-voce/Lab records etc.: 5

End Term Examination:

➢ **Theory 50**

- Written Examination

➢ **Practicum 20**

- Lab record, viva-voce, write up and execution of the program

Part C-Learning Resources

Recommended Books:

1. T. M. Apostol (1985), *Mathematical Analysis*, Narosa Publishing House, New Delhi.
2. R.R. Goldberg (1970), *Methods of Real Analysis*, Oxford & IBH Publishing Co., New Delhi.
3. D. Somasundaram and B. Choudhary (1997), *A First Course in Mathematical Analysis*, Narosa Publishing House, New Delhi.
4. S. Narayan (1980), *A Course of Mathematical Analysis*, S. Chand & Co., New Delhi.
5. R.V. Churchill and James Ward Brown (2009), *Complex Variables and Applications*, McGraw Hill Publishing Company.
6. H.S. Kasana (2011), *Complex Variable Theory and Applications*, PHI Learning Private Ltd.
7. D. G. Zill and P. D. Shanahan (2010), *A First Course in Complex Analysis with Applications*, Jones & Bartlett Publication, 2nd Edition.