5. Develop programs to find extreme values of functions of several variables, using concepts of calculus.
6. Implement algorithms to find the length of given space curves, applying knowledge of parametric equations and calculus.

List of Programs

1) Program to animate the plotted curves.
2) Programmes on Numerical Differentiation.
3) Program to evaluate the given integral using Trapezoidal rule/ Simpson's 1/3 rule/Simpson's 3/8 rule.
4) Program to find the approximate solution of a differential equation with initial condition by Picard's method of successive approximation
5) Program to solve an initial value problem using Euler's Method/ Euler's Modified Method.
6) Program to solve an initial value problem using Fourth Order Ruge-Kutta Method.
7) Program to find extreme values of functions of a several variables.
8) Program to find the length of a given space curve.
9) To find the Derivative, Partial Derivative and Jacobian of functions of a several variables.
10) To evaluate given multiple integrals.
11) Program to find Area and Volume of surfaces/regions/solids using Integration.
12) Solving Differential equations and plotting the solutions (Analytical Methods)

Note: The above list may be changed annually with the approval of the PG BOS in Mathematics.

IV Semester

MTH 552	Complex Analysis -II	4 Credits (48 hours)

Course Objectives

1. To provide an in-depth understanding of advanced topics in complex analysis, focusing on conformal mapping, Mobius maps, and their applications.
2. To explore and apply the fundamental theorems and principles such as the maximum modulus principle, Schwarz' lemma, and Liouville's theorem.
3. To study the properties and classifications of singularities and meromorphic functions, including the essential singularities and Picard's theorem.
4. To delve into advanced topics such as the residue theorem, analytic continuation, infinite products, and special functions like the Gamma and Zeta functions.

Course Outcomes

1. Understand and apply the principle of conformal mapping and the properties of Mobius maps in complex analysis.

2. Utilize the maximum modulus principle, Schwarz' lemma, and Liouville's theorem to solve complex analysis problems.
3. Analyze and classify singularities and meromorphic functions, and apply the residue theorem and Rouche's theorem in complex function theory.
4. Apply advanced concepts such as analytic continuation, infinite products, and special functions in solving complex analysis problems, including understanding the order and genus of entire functions.
5. Competence in applying advanced theorems and functions in complex analysis, including canonical products and gamma functions.

Contents

Unit I

Principle of conformal mapping, Basic properties of Mobius maps, Fixed points and Mobius maps, The cross-ratio and its invariance property, Maximum modulus principle, Hadamard's three circles/lines theorem. (12 Hours)

Unit II

Schwarz' lemma and its consequences, Liouville's theorem, Doubly periodic entire functions, Isolated and non-isolated singularities, Removable singularities, Poles, Illustration for poles through Laurent's series, Isolated singularities at infinity. (12 Hours)

Unit III

Meromorphic functions, Essential singularities and Picard's theorem, Residue at a finite point, Residue at the point at infinity, Residue theorem, Number of zeros and poles, Rouche's theorem.

(12 Hours)

Unit IV

Direct analytic continuation, Poisson integral formula, Infinite sums and meromorphic functions, Infinite product of complex numbers, Infinite product of analytic functions, Factorization of entire functions, The Gamma function, The Zeta function, Jensen's formula, The order and Genus of entire functions. (12 Hours)

References:

1. J. B. Conway – Functions of one Variable, Narosa, New Delhi, 1996.
2. Lars V. Ahlfors – Complex Analysis, McGraw Hill, 3rd Edition, 1979.
3. 2. B. R. Ash – Complex Variables, Dover Publications, 2nd Edition, 2007.
4. R. V. Churchill, J. W. Brown and R. F. Verlag – Complex Variables and Applications, Mc Graw Hill, 8th Edition, 2009.
5. S. Ponnuswamy and H. Silverman – Complex Variables with Applications, Birkhäuser, 2006.

References

[1] S. Ponnusamy - Foundations of Complex Analysis, Narosa, New Delhi, 2nd edition, 2005.

[2] Lars V. Ahlfors, *Complex Analysis*, 3rd Ed., McGraw Hill, 1979.