JYOTI NIVAS COLLEGE AUTONOMOUS
SYLLABUS FOR 2018 BATCH AND THEREAFTER

Programme: B.Sc. **Semester: VI**

MATHEMATICS PAPER VIII

Course Code: 18VIMA8 **No. of Hours: 45**

COURSE OBJECTIVES:

- Able to work independently and do in-depth study of various notions of mathematics.
- Seek to understand advances in various branches of mathematics.
- Able to explain the development of mathematics in its applications in other fields of sciences, economics and commerce
- Able to solve problems using Complex and numerical analysis.

LEARNING OUTCOMES:

- Define and analyze limits and continuity for complex functions as well as consequences of continuity
- Understand the significance of differentiability for complex functions and be familiar with the Cauchy-Riemann equations
- Conceive the concepts of analytic functions and will be familiar with the elementary complex functions and their properties
- Apply the concept and consequences of analyticity and the Cauchy-Riemann equations and of results on harmonic and entire functions including the fundamental theorem of algebra
- Understand the basic methods of complex integration and its application in contour integration
- Evaluate integrals along a path in the complex plane and understand the statement of Cauchy's Theorem and use Cauchy's integral theorem and formula to compute line integrals.
- Solve an algebraic or transcendental equation using an appropriate numerical method
- Approximate a function using an appropriate numerical method.
- Solve a differential equation using an approximate numerical method
- Evaluate a derivative at a value using an appropriate numerical method
- Solve a linear system of equations using an appropriate numerical method

UNIT 1

CHAPTER 1 COMPLEX ANALYSIS **30 HRS**

Recapitulations (Complex numbers-Cartesian and polar form-geometrical representation-complex- Plane-Euler's formula $e^{i\theta} = \cos\theta + i\sin\theta$) Functions of a complex variable-limit, continuity and differentiability of a complex function. Analytic function Cauchy-Riemann equations in Cartesian – Necessary and Sufficient conditions for analyticity (Cartesian form only)-Harmonic function-standard properties of analytic functions-construction of analytic function when real or imaginary part is given-Milne Thomson method. Complex integration-the complex integration –properties-problems. Cauchy's Integral theorem-proof using Green's theorem- direct consequences. Cauchy's Integral formula with proof-Cauchy's generalized formula for the derivatives with proof and applications for evaluation of simple line integrals - Cauchy's inequality with proof –Liouville's theorem with proof. Fundamental theorem of algebra with proof.

Transformations – conformal transformation – some elementary transformations namely Translation, rotation, magnification and inversion - examples.

The bilinear transformation (B.T.)-cross ratio-invariant points of a B.T.-properties-

(i) B.T. sets up a one to one correspondence between the extended z-plane and the extended w-plane.

(ii) Preservation of cross ratio under a B.T.

(iii) A B.T. transforms circles onto circles or straight lines.

Problems on finding a B.T., and finding images under a B.T.and invariant points of a B.T. Discussion of transformations $w = z^2$, $w = \sin z$, $w = \cosh z$ and $w = e^z$.

UNIT 2

CHAPTER 1 NUMERICAL METHODS II **15 HRS**

Numerical solutions of algebraic and Transcendental equations – method of successive bisection - method of false position – Newton-Raphson method. Numerical solutions of non-Homogeneous system of linear algebraic equations in three variables by Gauss Elimination, Gauss Seidel and Jacobi's method. Solutions of initial value problems for ordinary linear first order differential equations by Taylor's series,Euler's and Euler's modified method and Runge-Kutta 4^{th} order method. [Gauss Elimination, Gauss Seidel - for practical lessons only]

PRACTICALS:

LIST OF PROBLEMS

1. Some problems on Cauchy-Riemann equations (polar form).
2. Construct the analytic function using Milne-Thomson method

3. Illustrating orthogonality of the surfaces obtained from the real and imaginary parts of an analytic function.
4. Verify real and imaginary parts of an analytic function being harmonic (in polar coordinates).
5. Solving algebraic equation (Bisection method).
6. Solving algebraic equation (Regula-Falsiand Newton-Raphson methods).
7. Solving system of equations (Gauss Elimination method).
8. Solving system of equations (Jacobi's Iteration method, and Gauss-Seidel methods).
9. Solving ordinary differential equation by modified Euler's method.
10. Solving ordinary differential equation by Runge-Kutta method of 4^{th} order.

REFERENCES:

1. A R Vashista, *Complex Analysis*, Krishna Prakashana Mandir, 2012.
2. P Durai Pandian and Kayalai Pachaiappa Complex Analysis, S Chand Publications, 2014
3. Ponnusamy,Foundations of Complex Analysis, 2nd Edition, Alpha Science, 1995
4. S S Sastry, *Introductory methods of Numerical Analysis*, Prentice Hall of India, 2012.