Kadi Sarva Vishwavidyalaya
Faculty of Engineering & Technology
Second Year Bachelor of Engineering (ME,EE,CV,EC,AE) – Semester IV
(With effect from: Academic Year 2018-19)

Subject Code: CC402A-N	Subject Title: Complex Variable and Numerical Techniques
Pre-requisite	Branch: Mechanical, Electrical, Civil , Electronics & Communications, Automobile Engg.

Teaching scheme				Total Credit	Evaluation Scheme					
L	T	P	Total		Theory		Mid Sem Exam	CIA	Pract.	Total
Hours	Hours	Hours	Hours		Hours	Marks	Marks	Marks	Marks	Marks
03	01	00	04	04	03	70	30	50	00	150

Course Objective:
 The objective of this course is
- To present the foundations of many basic Mathematical tools and concepts related Engineering.
- To provide a coherent development to the students for the courses of various branches of Engineering like   Control Theory , Circuits and Networks, Digital Logic design, Fluid Mechanics, Machine Design etc
- To enhance the student's ability to think logically and mathematically.
- To give an experience in the implementation of Mathematical concepts which are applied in various field of Engineering.

Outline Of the Course:

Sr. No	Title of the Unit	Minimum Hours
1	Complex numbers and Calculus of Complex functions	9
2	Complex Integration	6
3	Power Series	8
4	Conformal Mapping and its applications	5
5	Interpolation	11
6	Solution of polynomial and transcendental equations	5
7	Numerical solution of Differential Equations	4
	Total	48

Total hours (Theory): 48
Total hours (Tutorial): 16
Total hours: 64

Detailed Syllabus

Sr. No	Topic	Lecture Hours	Weight age(%)
1	**Complex numbers and Calculus of Complex functions:** Basic Concepts of Complex Numbers and Elementary functions (Exponential, Trigonometric, Logarithmic function and Complex Exponent function, Hyperbolic functions, Inverse Hyperbolic functions). Limits of Functions, Continuity, Differentiability, Analytic functions, Cauchy-Riemann Equations, Necessary and Sufficient condition for analyticity (without proof), Laplace Equation, Harmonic Functions, Finding Harmonic Conjugate functions.	9	20%
2	**Complex Integration:** Line integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof).	6	15%
3	**Singularities and Residues:** Taylor and Laurent Theorems, Laurent series expansions. Zeros of analytic functions. Singularities of analytic functions and their classification. Residue Theorem, Rouche's Theorem, Argument Principle.	8	10%
4	**Conformal Mapping:** Mappings by elementary functions, Conformal mappings, Mobius transformations and their properties.	5	10%
5	**Interpolation:** Finite differences**,** Relation between operators, Interpolation using Newton's forward and backward difference formulae, central difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae. Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.	11	25%
6	**Solution of polynomial and transcendental equations** – Bisection method, Newton-Raphson method and Regula-Falsi method.	5	10%
7	**Numerical solution of Differential Equations:** Taylor, Euler, modified Euler and Runge-Kutta method of fourth order for differential equations.	4	10%
	Total	48	100%

Instructional Method and Pedagogy:

- In Tutorial, class will be divide into two subclasses & faculties will solve or assign the problem of the subject in each subclass.

- Attendance is compulsory in lectures and Tutorial which carries 05 Marks.

- At regular intervals assignments is given. In all, a student should submit all assignments of 30 marks each.

- Classroom participation and involvement in solving the problems in Tutorial rooms carries 05 Marks.

- One internal exam of 30 marks is conducted as a part of internal theory evaluation.

Learning Outcome:

At the end of the course

- The students will be able to think logically and mathematically in any field of engineering.
- The students will gain an experience in the implementation of Mathematical concepts which are applied in various field of Engineering.

Text/Reference Books:

1. . "Advanced Engineering Mathematics (8th Edition)", by E. Kreyszig, Wiley-India (2007).
2. "Complex variables and application" R. V. Churchill and J. W. Brown, (7th Edition), McGraw-Hill (2003).
3. "Higher Engineering Mathematics", B.S. Grewal, Khanna Publishers, 35th Edition, 2010.
4. " Introductory methods of numerical analysis", S.S. Sastry, PHI, 4th Edition, 2005.
5. " Complex Variable and Numerical Methods" by Dr. A.R. Patel and Dr.H.C. Patel , Engineering Publisher.
6. "Higher Engineering Mathematics" B V Ramana,Tata McGraw-Hill.
7. "Numerical Methods", P. Kandasamy, K. Thilagavathy, K. Gunavathi, S. Chand & Company, 2nd Edition, Reprint 2012.
8. " Introduction to Numerical Analysis", C. E. Froberg, (2nd Edition), Addison-Wesley.

List of Tutorials:

Sr. No.	Tutorial Content
1	Problem solving on "**Complex numbers and Calculus of Complex functions".**
2	Problem solving on "**Complex Integration"**
3	Assignment on "**Singularities and Residues:".**
4	Assignment on "**Conformal Mapping and its applications".**
5	Problem solving on "**Interpolation"**
6	Assignment on **"Solution of polynomial and transcendental equations".**
	Assignment on **"Numerical solution of Differential Equations".**