SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Engineering

B. Tech. Semester III/IV (Mechanical Engineering/Civil Engineering)

Subject Name: Complex Variables and Partial Differential Equations **Subject Code: BTAS11301**

Type of course: BSC
Prerequisite: Geometry, trigonometry, calculus and ODE.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total Marks
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	1		4	60	25	15	0	0	100

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Content	Total Hours	% Weightage
01	Polar Form of Complex Numbers, Powers and Roots, Complex Variable – Differentiation: Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.	12	25%
02	Complex Variable - Integration : Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof) Sequences, Series, Convergence Tests, Power Series, Functions Given by Power Series, Taylor and Maclaurin Series, Uniform Convergence.	08	20%
03	Laurent's series; Zeros of analytic functions, singularities, Residues, Cauchy Residue theorem (without proof), Residue Integration Method, Residue Integration of Real Integrals.	06	20%
04	First order partial differential equations, solutions of first order linear and nonlinear PDEs, Charpit's Method	08	20%

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05	Introduction to higher order linear partial differential equations, Solution by variable separable method, practical problems –wave equation, heat equation, Laplace equation.	08	15%

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	**20**	**10**	**10**	**10**	**0**

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels **(Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

Sr no	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1.	Advanced Engineering Mathematics	Erwin Kreyszig	Jhon Wiley and Sons	2010	10th Edition
2.	Advanced Engineering Mathematics,	PETER V. O'NEIL	Cengage Learning	(1 January 2012)	7th Edition
3.	Advanced Engineering Mathematics,	Dennis G. Zill	Jones and Bartlett Publishers	15 February 2010	4th edition
4.	A First Course in Complex Analysis with Applications	Dennis G. Zill, Patrick D. Shanahan,	Jones and Bartlett Publishers	(4 October 2013)	3rd edition
5.	Partial Differential Equations for Scientists and Engineers	Stanley J. Farlow	Dover Publications	(8 March 2012)	Reprint edition
6.	Elements of Partial Differential Equations	Ian N. Sneddon	Dover Publications	(1 January 2006)	1 st edition
7.	Complex Variables and Applications	J. W. Brown and R. V. Churchill	McGraw Hill	16 October 2013	9th edition
8.	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	2018	37th edition

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9.	A Text Book of Higher Engineering Mathematics	N. P. Bali	Laxmi Publications;	(1 January 2021)	10th edition

Course Outcome:

Sr. No.	After learning this subject, students will be able to	Weightage in %
CO-1	convert complex number in a polar form, plot the roots of a complex number in complex plane, find harmonic conjugate of analytic functions and apply conformal mapping in geometrical transformation	25%
CO-2	evaluate complex integration by using various result, test convergence of complex sequence and series and expand some analytic function in Taylor's series	20%
CO-3	find Laurent's series and pole of order, and apply Cauchy Residue theorem in evaluating some real integrals	20%
CO-4	form and solve first order linear and nonlinear partial differential equations	20%
CO-5	apply the various methods to solve higher order partial differential equations.	15%

Mapping with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12
CO-1	3	3	2	2	1	1	1	0	0	0	0	2
CO-2	3	3	2	2	1	1	1	0	0	0	0	2
CO-3	3	3	2	2	1	1	1	0	0	0	0	2
CO-4	3	3	1	1	1	1	1	0	0	0	0	2
CO-5	3	3	2	2	2	1	1	0	0	0	0	2
Rationale*												

Rationale*: All CO's are compatible and matching to the derived POs to several extents. Mathematical techniques and its applications help to analyse the real-world problems through science and technology viewpoints. From this, new ideas can be executed for the modification of existing systems for better outcomes, which satisfy and further justify the programme's outcomes. This subject is a powerful tool for solving a wide array of applied problems.

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List of Open learning website: NPTEL links

- https://www.youtube.com/playlist?list=PLbMVogVj5nJS_i8vfVWJG16mPcoEKMuWT
    - It covers major topics of Complex Analysis (Sr. No. 1, 2 ,3)
- https://www.youtube.com/playlist?list=PLLy_2iUCG87CX7wprwaVnYbVce1ftGlDV
    - It covers major topics of Partial Differential Equations (Sr. No. 4, 5)