



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**  
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF CIVIL ENGINEERING**

II Year - II Semester		L	T	P	C
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<b>COMPLEX VARIABLES AND STATISTICAL METHODS</b> (Common to all branches of Second Year except CSE and IT)					

**Course Objectives:**

- To familiarize the complex variables.
- To make the student capable of evaluating the integrals in complex domains
- To make the student capable of expanding a given function as a series and finding the poles and residues
- To make the student capable of evaluating the integrals in complex domains using residue theorem
- To familiarize the students with the foundations of probability and statistical methods.
- To equip the students to solve application problems in their disciplines.

**Course Outcomes:** At the end of the course students will be able to

- apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic (L3)
- find the differentiation and integration of complex functions used in engineering problems (L5)
- make use of the Cauchy residue theorem to evaluate certain integrals (L3)
- apply discrete and continuous probability distributions (L3)
- design the components of a classical hypothesis test (L6)
- infer the statistical inferential methods based on small and large sampling tests (L4)

**UNIT – I: Functions of a complex variable and Complex integration: (10 hrs)**

Introduction – Continuity – Differentiability – Analyticity –Cauchy-Riemann equations in Cartesian and polar coordinates – Harmonic and conjugate harmonic functions – Milne – Thompson method. Complex integration: Line integral – Cauchy’s integral theorem – Cauchy’s integral formula – Generalized integral formula (all without proofs) and problems on above theorems.

**UNIT – II: Series expansions and Residue Theorem: (10 hrs)**

Radius of convergence – Expansion in Taylor’s series, Maclaurin’s series and Laurent series. Types of Singularities: Isolated – Essential – Pole of order m – Residues – Residue theorem (without proof) – Evaluation of real integral of the types  $\int_{-\infty}^{\infty} f(x)dx$  and  $\int_c^{c+2\pi} f(\cos\theta, \sin\theta)d\theta$ .



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**UNIT – III: Probability and Distributions: (10 hrs)**

Review of probability and Baye's theorem – Random variables – Discrete and Continuous random variables – Distribution functions – Probability mass function, Probability density function and Cumulative distribution functions – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions.

**UNIT – IV: Sampling Theory: (8 hrs)**

Introduction – Population and Samples – Sampling distribution of Means and Variance (definition only) – Central limit theorem (without proof) – Representation of the normal theory distributions – Introduction to t,  $\chi^2$  and F-distributions – Point and Interval estimations – Maximum error of estimate.

**UNIT – V: Tests of Hypothesis: (10 hrs)**

Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance – One tail and two-tail tests – Tests concerning one mean and two means (Large and Small samples) – Tests on proportions.

**Text Books:**

1. **B. S. Grewal**, Higher Engineering Mathematics, 44<sup>th</sup> Edition, Khanna Publishers.
2. **Miller and Freund's**, Probability and Statistics for Engineers, 7/e, Pearson, 2008.

**Reference Books:**

1. **J. W. Brown and R. V. Churchill**, Complex Variables and Applications, 9<sup>th</sup> edition, Mc-Graw Hill, 2013.
2. **S.C. Gupta and V.K. Kapoor**, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.
3. **Jay I. Devore**, Probability and Statistics for Engineering and the Sciences, 8<sup>th</sup> Edition, Cengage.
4. **Shron L. Myers, Keying Ye, Ronald E Walpole**, Probability and Statistics Engineers and the Scientists, 8<sup>th</sup> Edition, Pearson 2007.
5. **Sheldon, M. Ross**, Introduction to probability and statistics Engineers and the Scientists, 4<sup>th</sup> Edition, Academic Foundation, 2011