



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

## COURSE CONTENT

COMPLEX ANALYSIS AND PROBABILITY DISTRIBUTIONS								
IV Semester: EEE								
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		C	CIA	SEE
AHSD13	Foundation	3	-	-	3	40	60	100
		Contact Classes:48		Tutorial Classes: Nil		Practical Classes: Nil		Total Classes: 48
Prerequisite: Basic Principles of Algebra and Calculus								

### I. COURSE OVERVIEW:

The course focuses on more advanced Engineering Mathematics topics which provide with the relevant mathematical tools required in the analysis of problems in engineering and scientific professions. The course includes complex functions and differentiation, complex integration, power series expansion of complex function and Probability of single random variables with its distributions. The mathematical skills derived from this course form a necessary base to analytical and design concepts encountered in the program.

### II. COURSE OBJECTIVES:

The students will try to learn:

- I The applications of complex variable in two dimensional complex potential theories.
- II The fundamental calculus theorems and criteria for the independent path on contour integral used in problems of engineering
- III The statistical tools which are essential for translating an engineering problem into probability model.

### III. COURSE OUTCOMES:

At the end of the course students should be able to:

- CO1 Identify the fundamental concepts of analyticity and differentiability for finding complex conjugates of complex transformations
- CO2 Apply integral theorems of complex analysis and its consequences for the analytic function with derivatives of all orders in simple connected region
- CO3 Extend the Taylor and Laurent series for expressing the function in terms of complex power series
- CO4 Apply Residue theorem for computing definite integrals by using the singularities and poles of real and complex analytic functions over closed curves.
- CO5 Apply the role of random variables and types of random variables, expected values of the discrete and continuous random variables under randomized probabilistic conditions
- CO6 Apply the parameters of random variable Probability distributions such as Binomial, Poisson by using their probability functions,

### IV. COURSE SYLLABUS:

#### MODULE-I: FUNCTIONS OF A COMPLEX VARIABLE (10)

Functions of a complex variable; concept of limits, continuity and differentiability of complex function, analyticity, Cauchy-Riemann equations (without proof); harmonic functions, constructions of analytic function, Milne-Thomson method.

#### MODULE-II: COMPLEX INTEGRATION (10)

Line integral: Evaluation along a path and by indefinite integration; Cauchy's integral theorem; Cauchy's integral formula; generalised Cauchy integral formula,

### MODULE-III: POWER SERIES OF COMPLEX FUNCTIONS (09)

Expansion of the complex function in Taylor's series, Maclaurin's series and Laurents's series (all theorems without proof); Singularities.

Residues: Cauchy Residue Theorem (without proof); Evaluation of integrals of the type  $\int_0^{2\pi} f(\cos\theta, \sin\theta)d\theta$  by residues.

### MODULE-IV: RANDOM VARIABLES (09)

Random variables: Discrete and continuous random variables, Probability distribution; Probability mass function and probability density functions,

### MODULE-V: PROBABILITY DISTRIBUTION (10)

Binomial distribution; Mean and variances of Binomial distribution, Poisson distribution: Poisson distribution as a limiting case of Binomial distribution, mean and variance of Poisson distribution. Normal distribution; Mean, Variance, Mode, Median of Normal distribution

### V. TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons Publishers, 9<sup>th</sup> edition, 2014.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

### VI. REFERENCE BOOKS:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/ed, Narosa Publications, 5<sup>th</sup> edition, 2016.
2. S. C. Gupta, V. K. Kapoor, "Fundamentals of Mathematical Statistics", S. Chand and Co., 10<sup>th</sup> edition, 2000.
3. N.P.Baliand Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
4. Richard Arnold Johnson, Irwin Miller and John E. Freund, "Probability and Statistics for Engineers", Prentice Hall, 8<sup>th</sup> edition, 2013.

### VII. ELECTRONIC RESOURCES:

1. [http://www.efunda.com/math/math\\_home/math.cfm](http://www.efunda.com/math/math_home/math.cfm)
2. <http://www.ocw.mit.edu/resources/#Mathematics>
3. <http://www.sosmath.com>
4. <http://www.mathworld.wolfram.com><http://www.mathworld.wolfram.com>

### VIII. MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk topics
4. Open end experiments
5. Definitions and terminology
6. Assignments
7. Model question paper - I
8. Model question paper - II
9. Lecture notes
10. E-learning readiness videos (ELRV)
11. Power point presentation