COMPLEX ANALYSIS AND SPECIAL FUNCTIONS

III Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB05	Foundation	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

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 special functions. The mathematical skills derived from this course form a necessary base to analytical and design concepts encountered in the program.

II. OBJECTIVES:

The course should enable the students to:

I	The applications of complex variable and conformal mapping 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 concepts of special functions and its application for solving the partial differential equation in mathematical physics and engineering.
IV	The Mathematics of combinatorial enumeration by using generating functions and Complex analysis for understanding the numerical growth rates..

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Identify** the fundamental concepts of analyticity and differentiability for finding complex conjugates, conformal mapping of complex transformations.	Understand
CO 2	**Apply** integral theorems of complex analysis and its consequences for the analytic function with derivatives of all orders in simple connected region.	Apply
CO 3	**Extend** the Taylor and Laurent series for expressing the function in terms of complex power series.	Apply
CO 4	**Apply** Residue theorem for computing definite integrals by using the singularities and poles of real and complex analytic functions over closed curves.	Apply
CO 5	**Determine** the characteristics of special functions for obtaining the proper and improper integrals for obtaining the proper and improper integrals.	Apply
CO 6	**Apply** the role of Bessel functions in the process of obtaining the series solutions for second order differential equation	Apply

IV. SYLLABUS:

MODULE -I	COMPLEX FUNCTIONS AND DIFFERENTIATION	Classes: 08

Complex functions differentiation and integration: Complex functions and its representation on argand plane, concepts of limit, continuity, differentiability, analyticity, Cauchy-Riemann conditions and harmonic functions; Milne-Thomson method, Bilinear Transformation.

MODULE –II	COMPLEX INTEGRATION	Classes: 10

Line integral: Evaluation along a path and by indefinite integration; Cauchy's integral theorem; Cauchy's integral formula; Generalized integral formula; Power series expansions of complex functions and contour Integration: Radius of convergence.

MODULE –III	POWER SERIES EXPANSION OF COMPLEX FUNCTION	Classes: 10

Expansion in Taylor's series, Maclaurin's series and Laurent series. Singular point; Isolated singular point; Pole of order m; Essential singularity; Residue: Cauchy Residue Theorem. Evaluation of Residue by Laurent Series and Residue Theorem.

Evaluation of integrals of the type

1. $\int_0^{2\Pi} f(\cos\theta, \sin\theta)d\theta$ 2. $\int_{-\infty}^{\infty} f(x)dx$

MODULE –IV	SPECIAL FUNCTIONS - I	Classes: 08

Improper integrals; Beta and Gamma functions: Definitions; Properties of Beta and Gamma function; Standard forms of Beta functions; Relationship between Beta and Gamma functions.

MODULE -VI	SPECIAL FUNCTIONS - II	Classes: 09

Bessel's Differential equation: Bessel function, properties of Bessel function, Recurrence relations of Bessel function, Generating function and Orthogonality of Bessel function, Trigonometric expansions involving Bessel function.

Text Books:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons Publishers, 10th Edition, 2014.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 42nd Edition, 2012.

Reference Books:

1. Churchill, R.V. and Brown, J.W, "Complex Variables and Applications", Tata Mc Graw-Hill, 8th Edition, 2012.
2. A. K. Kapoor, "Complex Variables Principles and Problem Sessions", World Scientific Publishers, 1st Edition, 2011.
3. Murray Spiegel, John Schiller, "Probability and Statistics", Schaum's Outline Series, 3rd Edition, 2010.

Web References:

1. http://www.efunda.com/math/math_home/math.cfm
2. http://ocw.mit.edu/resources/#Mathematics
3. http://www.sosmath.com/
4. http://mathworld.wolfram.com/

E-Text Books:

1. http://keralatechnologicaluniversity.blogspot.in/2015/06/erwin-kreyszig-advanced-engineering-mathematics-ktu-ebook-download.html
2. http://www.faadooengineers.com/threads/13449-Engineering-Maths-II-eBooks.