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	1	-	4	30	70	100
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes: 60**		

COURSE OBJECTIVES:
The students will try to learn:

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 equations in physics and engineering.
IV	The mathematics of combinatorial enumeration by using generating functions and complex analysis for understanding the numerical growth rates.

COURSE OUTCOMES:

CO 1	**Identify** the fundamental concepts of analyticity and differentiability for calculus of complex functions and their role in applied context.
CO 2	**Utilize the** concepts of analyticity for finding complex conjugates and their role in applied contexts.
CO 3	**Make use of the** conformal mapping technique for transferring geometric structure of complex functions with much more convenient geometry.
CO 4	**Apply** integral theorems of complex analysis and its consequences for the analytic function with derivatives of all orders in simple connected region.
CO 5	**Extend** the Taylor and Laurent series for expressing the function in terms of complex power series.
CO 6	**Classify** Singularities and Poles of Complex functions for evaluating definite and indefinite Complex integrals.
CO 7	**Apply** Residue theorem for computing definite integrals of real and complex analytic functions over closed curves.
CO 8	**Relate** the concept of improper integral and second order differential equations of special functions for formulating real world problems with futuristic approach.
CO 9	**Determine** the characteristics of special functions generalization on elementary factorial function for the proper and improper integrals.
CO 10	**Choose** an appropriate special function on physical phenomena arising in engineering problems and quantum physics.
CO 11	**Analyze** the role of Bessel functions in the process of obtaining the series solutions for second order differential equation.

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 $\int_0^{2\pi} f\, cosx, sinx\, dx$ and $\int_0^{\alpha} f\, x\, dx$		
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 -V	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. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons Publishers, 10th Edition, 2010 2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43rd Edition, 2015.		
Reference Books:		
1. T.K.V Iyengar, B.Krishna Gandhi, "Engineering Mathematics - III", S.Chand & Co., 12th Edition, 2015. 2. RK Jain & SRK Iyengar, "Advanced Engineering Mathematics", Narosa Publishers, 5th Edition, 2016.		
Web References:		
1. http://www.efunda.com/math/math_home/math.cfm 2. http://www.ocw.mit.edu/resourcs/#Mathematics 3. http://www.sosmath.com 4. http://www.mathworld.wolfram.com		
E-Text Books:		
1. http://www.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		