COMPUTATIONAL MATHEMATICS AND INTEGRAL CALCULUS

I Semester: CSE /ECE/ EEE/ IT **II Semester:** AE /CE/ ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHS003	Foundation	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Enrich the knowledge of solving Algebraic, transcendental equations by numerical methods.
II. Apply multiple integration to evaluate mass, area and volume of the plane.
III. Analyze gradient, divergence and curl to evaluate the integration over a vector field.
IV. Understand the Bessel's equation to solve them under special conditions with the help of series solutions.

COURSE LEARNING OUTCOMES (CLOs):

1. Solve the Algebraic and transcendental equations using Bisection method, Method of False position and Newton-Raphson method.
2. Apply numerical methods to interpolate the functions of values for equal intervals using finite differences.
3. Understand the Newton-Raphson method to the real-world problem for a finite barrier quantum well.
4. Evaluate the functional value by using Lagrange's interpolation formula for unequal intervals.
5. Understand the Lagrange's interpolation in real- world problem for neural network learning.
6. Apply method of least squares to fit linear and non linear curves.
7. Solve differential equation using single step method- Taylor's series.
8. Solve differential equation using multi step methods- Euler's, Modified Euler's and Runge Kutta methods.
9. Understand the multistep methods in real-world problem for real time Aircraft dynamics.
10. Understand the Runge-Kutta method in real- world problem for embedding the sensor signals into the iterative computation.
11. Evaluate double integral and triple integrals .
12. Utilize the concept of change order of integration to evaluate double integrals.
13. Determine the area and volume of a given curves using double and triple integration.
14. Understand transformation of co-ordinate system from plane to plane.
15. Analyze scalar and vector fields and compute the gradient, divergence and curl.
16. Understand integration of vector function.
17. Evaluate line, surface and volume integral of vectors.
18. Use Vector integral theorems to facilitate vector integration .
19. Analyze the concept of vector calculus in real- world problem for fluid dynamics.
20. Solve the Differential Equations by series solutions.
21. Understand Gamma function to evaluate improper integrals.
22. Analyze Bessel's function and study its properties.
23. Analyze Bessel's function as a Solution to Schrödinger equation in a cylindrical function of the second kind.
24. Understand gamma function to find application diverse areas as quantum physics.
25. Possess the knowledge and skills for employability and to succeed in national and International level competitive examinations.

UNIT-I	**ROOT FINDING TECHNIQUES AND INTERPOLATION**	**Classes: 10**
Root finding techniques: Solving algebraic and transcendental equations by Bisection method, Method of False position, Newton-Raphson method; Interpolation: Finite differences, forward differences, backward differences and central differences; Symbolic relations; Newton's forward interpolation, Newton's backward interpolation; Gauss forward central difference formula, Gauss backward central difference formula; Interpolation of unequal intervals: Lagrange,'s interpolation .		
UNIT -II	**CURVE FITTING AND NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**	**Classes: 08**
Fitting a straight line; Second degree curves; Exponential curve, power curve by method of least squares; Taylor's series method; Step by step methods: Euler's method, modified Euler's method and Runge-Kutta method for first order differential equations .		
UNIT-III	**MULTIPLE INTEGRALS**	**Classes: 10**
Double and triple integrals; Change of order of integration. Transformation of coordinate system; Finding the area of a region using double integration and volume of a region using triple integration.		
UNIT -IV	**VECTOR CALCULUS**	**Classes: 09**
Scalar and vector point functions; Gradient, divergence, curl and their related properties; Solenoidal and irrotational vector point functions; Scalar potential function; Laplacian operator; Line integral, surface integral and volume integral; Vector integral theorems: Green's theorem in a plane, Stoke's theorem and Gauss divergence theorem without proofs.		
UNIT -V	**SPECIAL FUNCTIONS**	**Classes: 08**
Gamma function, properties of gamma function; Ordinary point and regular singular point of differential equations; Series solutions to differential equations around zero, Frobenius method about zero; Bessel"s differential equation: Bessel functions properties, recurrence relations, orthogonality, generating function, trigonometric expansions involving Bessel functions.		

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 – I", S. Chand & Co., 12th Edition, 2015.
2. T.K.V Iyengar, B.Krishna Gandhi, "Mathematical Methods", S. Chand & Co., 7th Edition, 2015.
3. S. S. Sastry, "Introduction Methods of Numerical Analysis", Prentice-Hall of India Private Limited, 5th Edition, 2012.

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