ADVANCED MATHEMATICS IN AEROSPACE ENGINEERING

I Semester: AE

Course Code	Category	Hours /Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BAEC02	Core	3	0	0	3	30	70	100
ContactClasses:45	Tutorial Classes: Nil	Practical Classes: Nil				TotalClasses:45		

I. COURSE OVERVIEW:

The course focuses on more advanced Engineering Mathematics topics which provide the relevant mathematical tools required in the analysis of problems in engineering and scientific professions. The course includes root-finding techniques, Interpolation, and its applications, parabolic equations, Hyperbolic equations, Elliptic equations with applications. The mathematical skills derived from this course form a necessary base for analytical and design concepts encountered in the program.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The numerical methods of interpolation and approximation of solutions for Ordinary Differential Equations.
II. The mathematical approximation techniques of solutions for Partial Differential Equations.
III. The concept of Parabolic, Hyperbolic and Elliptic equations.

III. COURSE OUTCOMES:

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

CO 1	**Calculate** the unknown values of given equal and unequal spaced data by using Numerical methods.	**Apply**
CO 2	**Make use of** Lagrange's method and method of separation of variables for solving linear and nonlinear partial differential equations.	**Apply**
CO 3	**Interpret** the boundary conditions for functions of Parabolic equations by using partial derivatives.	**Apply**
CO 4	**Solve** the Parabolic equations by using Crank-Nicholson implicit method.	**Apply**
CO 5	**Compute** the numerical solution of the Hyperbolic Equations by using method of characteristics.	**Apply**
CO 6	**Apply** the properties of Elliptic Equations for curved boundary analysis by the five-point approximation to Polman's equation.	**Apply**

IV. COURSE SYLLABUS:

MODULE-I: INTERPOLATION (09)

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.

MODULE-II: PARTIAL DIFFERENTIAL EQUATIONS (09)

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equation by Lagrange method; method of separation of variables.

MODULE-III: PARABOLIC EQUATIONS (09)
Introduction to finite difference formula; Parabolic equations: Introduction, explicit finite difference approximation to one dimensional equation, Crank-Nicholson implicit method, derivation for boundary conditions.

MODULE-IV: HYPERBOLIC EQUATIONS (09)
Analytical solution of first order quasi linear equation. Numerical integration along a characteristic lax wenderoff explicit method. CFI condition Wenderoff's implicit approximation, propagation of discontinues numerical solution by the method of characteristics.

MODULE-V: ELLIPTIC EQUATIONS (09)
Introduction, finite differences in polar co-ordinates, formulas for derivative near a curved boundary analysis of the discretization error of the five point approximation to polman`s equation over a rectangle.

V. TEXT BOOKS:

1. G. D. Smith, "Numerical Solution of partial differential equations, finite Differences methods", Brunel University, Clarandon Press Oxford, 3rd Edition, 1985.
2. Joe D. Hoffman, "Numerical Methods for Engineers and scientists", Tata McGraw Hill, 2nd Edition, 2001.

VI. REFERENCE BOOKS:

1. A. R. Mitchel and D. F. Griffiths, "The Finite Difference Methods in Partial Differential equation", John Wiley, 1st Edition, 1980.
2. Larry J. Segerlind, "Applied Finite Element Analysis", John Wiley, 2nd Edition, 1984.

VII. 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

VIII. 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