INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS							
II Semester: AE / ME / CE / ECE / EEE / CSE / CSE (AI & ML) / CSE (DS) / CSE (CS) / IT							
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	

Course Code	Category	L	T	P	C	CIA	SEE	Total
AHSD08	**Foundation**	3	1	-	4	40	60	100

Contact Classes: 48	**Tutorial Classes: 16**	**Practical Classes: Nil**	**Total Classes: 64**
Prerequisite: Basic Principles of Matrices and Calculus			

I. COURSE OVERVIEW:
This course serves as a foundation course on differential equations and vector calculus. It includes techniques for solving ordinary differential equations, partial differential equations, vector differentiation and vector integration. It is designed to extract the mathematical developments, skills, from basic concepts to advance level of engineering problems to meet the technological challenges.

II. COURSE OBJECTIVES:
The students will try to learn:

I	The analytical methods for solving first and higher order differential equations with constant coefficients.
II	The analytical methods for formation and solving partial differential equations.
III	The physical quantities of vector valued functions involved in engineering field.
IV	The logic of vector theorems for finding line, surface and volume integrals.

III. COURSE OUTCOMES:
At the end of the course students should be able to:

CO1	Utilize the methods of differential equations for solving the orthogonal trajectories and Newton's law of cooling. cooling.
CO2	Solve the higher order linear differential equations with constant coefficients by using method of variation of parameters.
CO3	Make use of analytical methods for PDE formation to solve boundary value problems.
CO4	Identify various techniques of Lagrange's method for solving linear partial differential equations which occur in science and engineering.
CO5	Interpret the vector differential operators and their relationships for solving engineering problems.
CO6	Apply the integral transformations to surface, volume and line of different geometrical models in the domain of engineering.

IV. COURSE CONTENT:
MODULE-I: FIRSTORDERAND FIRST DEGREE ODE (10)
Exact differential equations, Equations reducible to exact differential equations, linear and Bernoulli's equations, Applications: Orthogonal Trajectories (Cartesian Coordinates) Newton's law of cooling.

MODULE-II: ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER (10)
Second order linear differential equations with constant coefficients: non-homogeneous terms of the type e^{ax}, $\sin ax$, $\cos ax$, polynomials in x, $e^{ax}V(x)$ and method of variation of parameters.

MODULE-III: PARTIAL DIFFERNTIATIAL EQUATIONS (09)

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions.

Solutions of first order linear equations: method of grouping and method of multipliers.

MODULE–IV: VECTOR DIFFERNTIATION (09)

Scalar and vector point functions; definitions of gradient, divergent and curl with examples; solenoidal and irrotational vector point functions; scalar potential function.

MODULE–V: VECTOR INTEGRATION (10)

Line integral, surface integral and volume integral, Green's theorem in a plane, Stoke's theorem and Gauss divergence theorem without proofs.

V. TEXT BOOKS:
1. B. S. Grewal, *Higher Engineering Mathematics*, 44/e, Khanna Publishers, 2017.
2. Erwin Kreyszig, *Advanced Engineering Mathematics*, 10/e, John Wiley & Sons, 2011.

VI. REFERENCE BOOKS:
1. R. K. Jain and S. R. K. Iyengar, *Advanced Engineering Mathematics*, 3/ed, Narosa Publications, 5th Edition, 2016.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas, *Calculus*, 13/e, Pearson Publishers, 2013.
3. N.P.Bali and Manish Goyal, *A text book of Engineering Mathematics*, Laxmi Publications, Reprint, 2008
4. Dean G. Duffy, *Advanced Engineering Mathematics with MATLAB*, CRC Press.
5. Peter O'Neil *Advanced Engineering Mathematics*, Cengage Learning.
6. B.V. Ramana, *Higher Engineering Mathematics*, McGraw Hill Education.

VII. ELECTRONIC RESOURCES:
1. Engineering Mathematics - I, By Prof. Jitendra Kumar |https://onlinecourses.nptel.ac.in/noc23_ma88/preview
2. Advanced Calculus for Engineers, By Prof. Jitendra Kumar, Prof. Somesh Kumar https://onlinecourses.nptel.ac.in/noc23_ma86/preview
3. http://www.efunda.com/math/math_home/math.cfm
4. http://www.ocw.mit.edu/resourcs/#Mathematics
5. http://www.sosmath.com
6. http://www.mathworld.wolfram.com

VIII. MATERIAL ONLINE:
1. Course template
2. Tech-talk topics
3. Assignments
4. Definition and terminology
5. Tutorial question bank
6. Model question paper – I
7. Model question paper – II
8. Lecture notes
9. Early lecture readiness videos (ELRV)
10. Power point presentations