



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

DIP - MATHEMATICS								
III Semester (Lateral entry students): Common for all branches								
Course Code	Category	Hours/Week			Credits	Maximum Marks		
ADPE01	MC	L	T	P	C	CIA	SEE	Total
		-	-	-	-	40	60	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 48			
Prerequisite: Basic Principles of Matrices and Calculus								

I. COURSE OVERVIEW:

This course provides a strong mathematical foundation through matrices, eigenvalues and eigenvectors, functions of single and several variables, multiple integrals, and vector calculus, equipping students with analytical and computational skills for engineering problem-solving. It enables mathematical modeling and optimization of complex systems, with applications in simulation, image processing, artificial intelligence, data science, and multidisciplinary engineering.

II. COURSE OBJECTIVES:

The students will try to learn:

- I The concept of the rank of a matrix, solve the system of linear equations, eigen values, eigen vectors.
- II The geometrical interpretation of mean value theorems for solving maxima and minima problems of functions of two and three variables.
- III The evaluation of multiple integrals and their applications.
- 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 Determine the rank of a matrix and solve systems of linear equations using elementary row operations.
- CO2 Utilize the Eigen values, Eigen vectors for developing spectral matrices.
- CO3 Apply the mean value theorems for finding analytical problems involving derivatives.
- CO4 Interpret the maxima and minima of given functions by finding the partial derivatives.
- CO5 Interpret the applications of integral calculus to determining the area and volume of bounded regions.
- CO6 Apply the integral transformations to surface, volume and line of different geometrical models in the domain of engineering.

IV. COURSE CONTENT:

MODULE-I: MATRICES (09)

Rank of a matrix by Echelon form and Normal form, Inverse of non-singular matrices by Gauss-Jordan method, system of linear equations: Solving system of homogeneous and non-homogeneous equations. Gauss Seidel iteration method.

MODULE-II: EIGEN VALUES AND EIGEN VECTORS (10)

Linear transformation and orthogonal transformation: Eigen values, Eigen vectors and their properties, diagonalization of a matrix, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, Quadratic forms and nature of the Quadratic forms, reduction of Quadratic form to canonical form by orthogonal transformation

MODULE-III: FUNCTIONS OF SINGLE AND SEVERAL VARIABLES (10)

Mean value theorems: Rolle's theorem, Lagrange's theorem, Cauchy's theorem-without proof. Functions of several variables: Partial differentiation, Jacobian, functional dependence, maxima and minima of functions of two variables and three variables, method of Lagrange multipliers.

MODULE-IV: MULTIPLE INTEGRALS (10)

Evaluation of double integrals (cartesian and polar coordinates), change of order of integration (only cartesian coordinates), evaluation of triple integrals (only cartesian coordinates).

MODULE-V: VECTOR CALCULUS (09)

Vector point functions and scalar point functions, gradient, divergence and curl, directional derivatives, vector identities, scalar potential functions, solenoidal and irrotational vectors. Line, surface and volume integrals. theorems of Green, Gauss and Stokes (without proofs) and their applications.

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.

V. 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.

VI. 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/resources/#Mathematics>
5. <http://www.sosmath.com>
6. <http://www.mathworld.wolfram.com>

VII. 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