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

COURSE CONTENT

MATRICES AND CALCULUS							
I Semester: AE / ME / CE / ECE / EEE / CSE / CSE (AI & ML) / CSE (DS) / CSE (CS) / IT							

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AHSD02	Foundation	3	1	-	4	40	60	100
Contact Classes: 48	**Tutorial Classes: 16**	**Practical Classes: Nil**				**Total Classes: 64**		
Prerequisite: Basic Principles of Algebra and Calculus								

I. COURSE OVERVIEW:

This course Matrices and Calculus is a foundation course of mathematics for all engineering branches. The concepts of Matrices, Eigen Values, Eigen Vectors, Functions of Single and Several Variables, Fourier Series and Multiple Integrals. This course is applicable for simulations, colour imaging process, finding optimal solutions in all fields of industries.

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 approach to the mean value theorems and their application to the mathematical problems.
III	The Fourier series expansion in standard intervals as well as arbitrary intervals.
IV	The evaluation of multiple integrals and their applications.

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

CO 1	Determine the rank and solutions of linear equations with elementary operations.
CO 2	Utilize the Eigen values, Eigen vectors for developing spectral matrices.
CO 3	Make use of Cayley-Hamilton theorem for finding powers of the matrix.
CO 4	Interpret the maxima and minima of given functions by finding the partial derivates.
CO 5	Apply the Fourier series expansion of periodic functions for analyzing the wave forms.
CO 6	Determine the area of solid bounded regions by using the integral calculus.

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.

MODULE - II: EIGEN VALUES AND EIGEN VECTORS (10)
Eigen values, eigen vectors and their properties (without proof), Cayley-Hamilton theorem (without proof), verification, finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalization of a matrix.

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: FOURIER SERIES (09)
Fourier expansion of periodic function in a given interval of length 2π, Fourier series of even and odd functions, Fourier series in an arbitrary interval, half- range Fourier sine and cosine expansions.

MODULE – V: 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).

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. ELECTRONICS RESOURCES:
1. Engineering Mathematics - I, By Prof. Jitendra Kumar | IIT Kharagpur
   https://onlinecourses.nptel.ac.in/noc23_ma88/preview
2. Advanced Calculus for Engineers, By Prof. Jitendra Kumar, Prof. Somesh Kumar | IIT Kharagpur
   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