

# CALCULUS AND LINEAR ALGEBRA

Semester	: I	CIE Marks	: 40
Course Code	: 18MAT11	SEE Marks	: 60
Teaching Hours/week (L:T:P)	: 3:2:0	Exam Hours	: 03
Credits : 04			

**Course Learning Objectives:** This course Calculus and Linear Algebra (18MAT11) will enable students:

- To familiarize the important tools of calculus and differential equations that are essential in all branches of engineering.
- To develop the knowledge of matrices and linear algebra in a comprehensive manner.

## MODULE-I

**Differential Calculus-1:** Review of elementary differential calculus, Polar curves - angle between the radius vector and tangent, angle between two curves, pedal equation. Curvature and radius of curvature- Cartesian and polar forms; Centre and circle of curvature (All without proof-formulae only) –applications to evolutes and involutes.

(RBT Levels: L1 & L2)

## MODULE-II

**Differential Calculus-2:** Taylor's and Maclaurin's series expansions for one variable (statements only), indeterminate forms - L'Hospital's rule. Partial differentiation; Total derivatives-differentiation of composite functions. Maxima and minima for a function of two variables; Method of Lagrange multipliers with one subsidiary condition. Applications of maxima and minima with illustrative examples. Jacobians-simple problems.

(RBT Levels: L1 & L2)

## MODULE-III

**Integral Calculus:** Review of elementary integral calculus.

**Multiple integrals:** Evaluation of double and triple integrals. Evaluation of double integrals- change of order of integration and changing into polar co-ordinates. Applications to find area volume and centre of gravity

**Beta and Gamma functions:** Definitions, Relation between beta and gamma functions and simple problems.

(RBT Levels: L1 & L2)

## MODULE-IV

**Ordinary differential equations (ODE's) of first order:**

Exact and reducible to exact differential equations. Bernoulli's equation.



Applications of ODE's-orthogonal trajectories, Newton's law of cooling and L-R circuits. Nonlinear differential equations: Introduction to general and singular solutions ; Solvable for p only; Clairaut's and reducible to Clairaut's equations only.  
(RBT Levels : L1, L2 & L3)

#### MODULE-V

**Linear Algebra:** Rank of a matrix-echelon form. Solution of system of linear equations – consistency. Gauss-elimination method, Gauss –Jordan method and Approximate solution by Gauss-Seidel method. Eigen values and eigenvectors-Rayleigh's power method. Diagonalization of a square matrix of order two.

(RBT Levels : L1, L2 & L3)

#### Textbooks:

1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.
2. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed.(Reprint), 2016.

#### Reference books:

1. C.Ray Wylie, Louis C.Barrett : "Advanced Engineering Mathematics", 6th Edition, 2. McGraw-Hill Book Co., New York, 1995.
2. James Stewart : "Calculus –Early Transcendentals", Cengage Learning India Private Ltd., 2017.
3. B.V.Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
4. Srimanta Pal & Subobh C Bhunia: "Engineering Mathematics", Oxford University Press, 3rd Reprint, 2016.
5. Gupta C.B., Singh S.R. and Mukesh Kumar: "Engineering Mathematics for Semester I & II", Mc-Graw Hill Education (India) Pvt.Ltd., 2015.

#### Web links and Video Lectures:

1. <http://nptel.ac.in/courses.php?disciplineID=111>
2. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
3. <http://academicearth.org/>
4. VTU EDUSAT PROGRAMME - 20

**Course Outcomes:** On completion of this course, students are able to:

**CO1 :** Apply the knowledge of calculus to solve problems related to polar curves and its applications in determining the bentness of a curve.

**CO2 :** Learn the notion of partial differentiation to calculate rates of change of multivariate functions and solve problems related to composite functions and Jacobians.



**CO3 :** Apply the concept of change of order of integration and variables to evaluate multiple integrals and their usage in computing the area and volumes.

**CO4 :** Solve first order linear/nonlinear differential equation analytically using standard methods

**CO5 :** Make use of matrix theory for solving system of linear equations and compute eigenvalues and eigenvectors required for matrix diagonalization process.

**Question Paper Pattern:**

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have ten full questions carrying equal marks.
- Each full question carries 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.