VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E.SYLLABUS FOR 2018-2022

Calculus and Linear Algebra

(Common to all branches)
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018-19)

Course Code : 18MAT11	**CIE Marks : 40**
Contact Hours/Week : 05(3L+2T)	**SEE Marks: 60**
Total Hours:50 (8L+2T per module)	**Exam Hours:03**
Semester : I	**Credits: 04 (3:2:0)**

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 and 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 and L3)

Text Books:

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)
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.

Calculus and Linear Algebra (18MAT11)

BLOW UP SYLLABUS

Recommended during workshop/s organized by VTU, Belgavi during May, 2018

Topics	Topics To be Covered	Hours
MODULE - I		
DIFFERENTIAL CALCULUS – 1		
1. Review of elementary differential calculus, Polar curves - angle between the radius vector and tangent, angle between two curves, pedal equation	Discussion restricted to derivation and problems as suggested in Article No.4.7 (1, 2) and 4.8 of Text Book 1 *(No Question to be set on Review of elementary Differential Calculus)*	**3L**
2.Curvature and radius of curvature- Cartesian and polar forms ,Centre and circle of curvature (All without proof- formulae only)	Discussion restricted to problems as suggested in Article No.4.10,4.11 (1,4) and 4.12(1) of Text Book 1	**4L**
3. Applications to evolutes and involutes. (RBT Levels: L1 & L2)	Applications of evolutes and involutes restricted to conic sections 4.12(2) of Text Book 1	**1L**
Tutorials	Involvement of faculty and students in identifying the Engg. Applications, Problems and Solutions about the module.	**2T**
	Total	**10**
MODULE - II		
DIFFERENTIAL CALCULUS – 2		
1. Taylor's and Maclaurin's series expansions for one variable (statements only), indeterminate forms - L'Hospital's rule.	(i)Discussion restricted to problems on Article No.4.4 of Text book 1 (*No question to be set on Taylor's series*) (ii)Discussion restricted to $0^0, \infty^0, 1^\infty$ only, Article No.4.5 of Text Book 1.	**3L**
2. 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. 3. Jacobians- Simple problems. (RBT Levels: L1 & L2)	(i)Discussion and coverage of contents as suggested in article 5.1 (Introduction only), 5.5(1),5.11 and 5.12 of Text Book 1. Discussion and problems restricted to article No.5.7 (1) of Text Book 1.	**4L** **1L**
Tutorials	Involvement of faculty and students in identifying the Engg. Applications, Problems and Solutions about the module.	**2T**
	Total	**10**

MODULE - III		
INTEGRAL CALCULUS		
1. 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.	(i)Review of Integral Calculus Article No.6.2 &6.3 of Text Book 1. (ii)Discussion and Problems as suggested in Article No.7.1-7.5 of Text Book 1. *(No Question to be set on Review of elementary Integral Calculus)*	**4L**
2.Applications to find area, volume and center of gravity(Using double integration only)	Application oriented problems restricted to article No.7.6, 7.7(1),7.8 & 7.10 of Text Book 1.	**2L**
3.Beta and Gamma functions: definitions, Relation between beta and gamma functions and simple problems. (RBT Levels: L1 & L2)	Discussion and problems restricted to Article No.7.15 & 7.16 of Text Book 1.	**2L**
Tutorials	Involvement of faculty and students in identifying the Engg. Applications, Problems and Solutions about the module.	**2T**
	Total	**10**
MODULE - IV		
ORDINARY DIFFERENTIAL EQUATIONS (ODE'S) OF FIRST ORDER		
1. 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.	(i) In the case of reducible to exact equations, I.F. is restricted to $\frac{1}{M}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ & $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ only, Article No.11.11,11.12(4) of Text Book 1 (ii) Discussion and Problems restricted to Article No. 11.10 of Text Book 1 (iii) Application oriented problems restricted to article no.12.3(1,2), 12.5 & 12.6 of Text Book 1	**5L**
2. Nonlinear differential equations: Introduction to general and singular solutions; Solvable for p only; Clairaut's and reducible to Clairaut's equation only. (RBT Levels: L1, L2 & L3)	Discussion and problems restricted to Article No.11.13(Case 1) & 11.14 of Text Book 1.	**3L**
Tutorials	Involvement of faculty and students in identifying the Engg. Applications, Problems and Solutions about the module.	**2T**
	Total	**10**

MODULE - V		
LINEAR ALGEBRA		
1. 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**.**	Discussion and problems as suggested in Article No.2.7, 2.10, 28.6(1,2) and 28.7(2) of Text Book 1**.**	**4L**
2. Eigen values and eigen vectors-Rayleigh's power method. Diagonalization of a square matrix of order two. (RBT Levels: L1, L2 & L3)	Discussion and problems as suggested in Article No. 4.0, 20.8, 8.4 of Text Book 2.	**4L**
Tutorials	Involvement of faculty and students in identifying the Engg. Applications, Problems and Solutions about the module.	**2T**
	Total	**10**

Text Books:

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.