D. Syllabus Detailing and Learning objectives

Module	Chapter	Detailed Content	Syllabus Detailing	Learning Objectives
Module 1	**Matrices**	1.1. Types of Matrices (symmetric, skew-symmetric, Hermitian, Skew Hermitian, Unitary, Orthogonal Matrices and properties of Matrices). Rank of a Matrix using Echelon forms, reduction to normal form, PAQ in normal form, system of homogeneous and non – homogeneous equations, their consistency and solutions. Linear dependent and independent vectors. Application of inverse of a matrix to coding theory.	**Purpose:** To make students understand types of matrices, properties, rank of a matrix, system of homogeneous and non-homogeneous system of equations, application of inverse of a matrix to coding theory. **Scope –** 1. **Academic Aspects**- Find Rank, solution of homogeneous and non – homogeneous equations, Linear dependent and independent vectors and application of inverse of a matrix to coding theory. 2. **Technology Aspect**- Sci Lab, Matlab 3. **Application Aspect**- In Computers, mapping of one system to other, etc.. **Students Evaluation –** 1. Theory Questions to be asked on matrices. 2. Tutorial on matrices. 3. Corresponding short questions can be asked on matrices in GATE, GMAT, GRE and aptitude test for placement.	1. List different type of matrices. (R) 2. Discuss theorems on matrices. (U) 3. Illustrate rank of matrices using normal form (U) 4. Use matrices to calculate the solution of homogeneous equation. (A) 5. Use matrices to calculate the solution of non-homogeneous equation. (A) 6. Identify linear dependence and independence of vectors. (A)
Module2	**System of Linear Equations,** **Numerical**	2.1. Solution of system of linear algebraic equations, by (1) Gauss Elimination Method, (2) Gauss	**Purpose:** To make students understand solution of system of linear algebraic equations by Gauss Elimination Method, Gauss Jacobi Iteration Method and Gauss Seidal Iteration Method, solution of Transcendental Equations by Newton Raphson method and Regula –Falsi Equation,	1. Determine the solutions of system of equations using Gauss elimination method. (A) 2. Determine the solutions of system of equations using Gauss Siedal method and

	Solutions of Transcendental Equations and Indeterminate forms	Jacobi Iteration Method, (3) Gauss Seidal Iteration Method. (Scilab programming for above methods is to be taught during lecture hours) 2.2. Solution of Transcendental Equations: Solution by Newton Raphson method and Regula – Falsi Equation. 2.3. Indeterminate forms, L- Hospital Rule, problems involving series.	Indeterminate forms and L- Hospital Rule. Scope – 1. **Academic Aspects**- Solvesystem of linear algebraic equations and the transcendental equation andevaluate the limits,. 2. **Technology Aspect**- Sci Lab, Matlab 3. **Application Aspect**- Calculus and limits involving an algebraic combination of functions, Analytic Geometry. **Students Evaluation –** 1. Theory Questions to be asked on System of Linear Equations, Numerical Solutions Of Transcendental Equations and Indeterminate forms. 2. Tutorial onSystem of Linear Equations, Numerical Solutions of Transcendental Equations and Indeterminate forms. 3. Corresponding short questions can be asked on System of Linear Equations, Numerical Solutions of Transcendental Equations and Indeterminate forms in tutorials, GATE, GMAT, GRE and aptitude test for placement.	Gauss Jacobi method (A) 3. Determine the solutions of Transcendental Equations. (A) 4. DefineL'Hospitals rule. (R) 5. Evaluate the limits using L'Hospitals rule. (U) 6. Use series expansion to calculate the limits. (U)
Module 3	**Partial Differentiation**	3.1. Partial Differentiation: Partial derivatives of first and higher order. Total differentials, differentiation of composite andimplicit functions. 3.2. Euler's Theoremon Homogeneous	**Purpose:** To make students understand partial derivatives of first and higher order, total differentials, differentiation of composite and implicit functions, Euler's Theorem on Homogeneous functions. **Scope –** 1. **Academic Aspects**- Find partial derivatives of first and higher orders, total derivatives, differentiation of composite and implicit functions. 2. **Technology Aspect**- Sci Lab, Matlab 3.**Application Aspect**- In finding the absolute and relative extrema of a function, continuity, momentum,	1. State the definition of partial derivative and write higher order partial derivative. **(R)** 2. Discuss various examples on partial derivative. **(U)** 3. Explain composite functions and derive the composite formula .Discuss various examples on composite functions. **(U)** 4. Explain implicit functions and discuss the formula for implicit functions . Discuss various examples on implicit functions.**(U)**

		functions with two and three independent variables (with proof). Deductions from Euler's Theorem	electrostatics etc. **Students Evaluation –** 1. Theory Questions to be asked on Partial Differentiation. 2. Tutorial on Partial Differentiation. 3. Corresponding short questions can be asked on Partial Differentiation in GATE, GMAT, GRE and aptitude test for placement.	5. State the definition of homogeneous functions and write Euler's formula.**(R)** 6. Illustrate various formulae using Euler's theorem.**(A)**
Module4	**ApplicationsofPartialDifferentiation,ExpansionofFunctions**	4.1 Maxima and Minima of a function of two independent variables, Jacobian. 4.2 Taylor's Theorem (Statement only) and Taylor's series, Maclaurin's series (Statement only). Expansion of , sin(x), cos(x), tan(x), sinh(x), cosh(x), tanh(x), log(1+x), $sin^{-1}(x)$, $cos^{-1}(x)$, $tan^{-1}(x)$, Binomial series.	**Purpose:**To make students understand Maxima and Minima of a function of two independent variables, Jacobian, Taylor's Theorem and Taylor's series, Maclaurin's series, Expansion of e^x, sin(x), cos(x), tan(x), sinh(x), cosh(x), tanh(x), log(1+x), $sin^{-1}(x)$, $cos^{-1}(x)$,$tan^{-1}(x)$, Binomial series. **Scope –** 1. **Academic Aspects**- Find maxima & minima of a function, Taylor's and Maclaurin's Series, expansion of basic function of x. 2. **Technology Aspect**- Sci Lab, Matlab 3. **Application Aspect**- Jacobian, Taylor's series expansion of two variable, Laplace transform of error function etc.. **Students Evaluation –** 1. Theory Questions to be asked on Applications of Partial Differentiation, Expansion of Functions. 2. Tutorial on Applications of Partial Differentiation, Expansion of Functions. 3. Corresponding short questions can be asked on Applications of Partial Differentiation, Expansion of Functions in GATE, GMAT, GRE and aptitude test for placement.	1 Explain concept of jacobian of functions**(U)** 2. Evaluatejacobian of an implicit function**(U)** 3. Calculate partial derivative of animplicit function usingjacobian.**(A)** 4. Test the function for maxima and minima. **(A)** 5.Illustrate expansion of functions using Maclaurin's series. **(A)** 6. ExplainTaylor's series and compare with Maclaurin's series.**(U)**

Module 5	**Complex Numbers**	5.1 Powers and Roots of Exponential and Trigonometric Functions. 5.2. Expansion of $\sin^n\theta$, $\cos^n\theta$ in terms of sines and cosines of multiples of θ and Expansion of sinnθ, cosnθ in powers of sinθ, cosθ 5.3. Circular functions of complex number and Hyperbolic functions. Inverse Circular and Inverse Hyperbolic functions. Separation of real and imaginary parts of all types of Functions.	**Purpose:**To make students understand Powers and Roots of Exponential and Trigonometric Functions, expansion of $\sin^n\theta$, $\cos^n\theta$ in terms of sines and cosines of multiples of θ and expansion of sinnθ, cosnθ in powers of sinθ, cosθ, Circular functions of complex number and Hyperbolic functions, InverseCircular and Inverse Hyperbolic functions, Separation of real and imaginary parts of all types of Functions. **Scope –** 1. **Academic Aspects**- Find Powers and Roots of Exponential and Trigonometric Functions, Expansion of $\sin^n\theta$, $\cos^n\theta$, Circular functions of complex number and Hyperbolic functions. 2. **Technology Aspect**- Sci Lab, Matlab 3. **Application Aspect**- Complex variables, Laplace Transform, Fourier Series etc.. **Students Evaluation –** 1. Theory Questions to be asked on Complex Numbers. 2. Tutorial on Complex Numbers. 3. Corresponding short questions can be asked on Complex Numbers in GATE, GMAT, GRE and aptitude test for placement.	1. State complex numbers and list all the properties of it. **(R)** 2. Calculate roots of an equation usingDe'Moivre's theorem. **(A)** 3. Explain the expansion of trigonometric function. **(U)** 4.Define hyperbolic functions and list standard formulae for them.**(R)** 5. Define inverse hyperbolic functions and state standard formulae for them.**(R)** **6.**Identify the real and imaginary parts of complex expressions.**(A)**
Module 6	**Logarithm of Complex Numbers, Successive Differentiation**	6.1. Logarithmic functions, Separation of real and Imaginary parts of Logarithmic Functions. 6.2. Successive differentiation:	**Purpose:** To make students understand Logarithmic functions, Separation of real and Imaginary parts of Logarithmic Functions, successive differentiation: n^{th} derivative of standard functions, Leibnitz's Theorem. **Scope –** 1. **Academic Aspects**- Separate real and imaginary parts of Logarithmic functions, find n^{th} derivative of standard	1. Definelogarithm of complex numbers. **(R)** 2. Identify the real and imaginary parts of logarithmic expressions.**(A)** 3. Definesuccessive differentiation and list standard formulae.**(R)**

		n^{th}derivative of standard functions. Leibnitz's Theorem (without proof) and problems	functions, Leibnitz's Theorem. 2. **Technology Aspect**- Sci Lab, Matlab 3. **Application Aspect**- Complex Variables, In automation and aerospace industry etc... **Students Evaluation –** 1. Theory Questions to be asked on Logarithm of Complex Numbers, Successive Differentiation. 2. Tutorial on Logarithm of Complex Numbers, Successive Differentiation. 3. Corresponding short questions can be asked on Logarithm of Complex Numbers, Successive Differentiation in GATE, GMAT, GRE and aptitude test for place.	4. Determine n^{th} order derivative of a function.**(A)** 5. State Leibnitz's theorem and problems on it.**(R)** 6. Deducen^{th} order derivative at x=0 using Leibnitz's theorem. (**A**)

C.Course Objectives and Course outcomes

Sr.	Module	Chapter	Course Objectives (COB) Students shall be able to :	Course Outcomes (CO) After completion of the course the learner should be able to:
	Module 1	**Matrices**	**COB1**. Get familiar with types of Matrices, rank of a Matrix using Echelon forms, reduction to normal form, PAQ in normal form, system of homogeneous and non – homogeneous equations, their consistency and solutions, linear dependent and independent vectors, application of inverse of a matrix to coding theory.	**CO1**-Listdifferent type of matrices, discuss theorems on matrices, illustrate rank of matrices using normal form, use matrices to calculate the solution of homogeneous and non-homogeneous equation, identify linear dependence and independence of vectors.
	Module 2	**Indeterminate forms, Numerical Solutions of Transcendental Equations and System of Linear Equations**	**COB2.**Get familiar with indeterminate form, numerical solution of Transcendental equations by Newton Raphson method and Regula–Falsi Equation, solution of system of linear algebraic equations by Gauss Elimination Method, Gauss Jacobi Iteration Method and Gauss Seidal Iteration Method.	**CO2–**Define L'Hospitals rule, evaluate the limits using L'Hospitals rule, use series expansion to calculate the limits, determine the solutions of Transcendental Equations, determine the solutions of system of equations using Gauss elimination method, Gauss Siedal method and Gauss Jacobi method.
	Module 3	**Partial Differentiation**	**COB3.** Get familiar with partial derivatives of first and higher order. Total differentials, differentiation of composite and implicit functions, Euler's Theorem on Homogeneous functions with two and three independent variables, deductions from Euler's	**CO3–** State the definition of partial derivative and write higher order partial derivative, discussvarious examples on partial derivative, explain composite functions and derive the composite formula, discuss various examples on composite functions, explain implicit functions and discuss the formula for implicit functions, discuss various examples on implicit functions, state the

			Theorem	definition of homogeneous functions and write Euler's formula, illustrate various formulae using Euler's theorem.
	Module 4	**Applications of Partial Differentiation , Expansion of Functions**	**COB4.**Define Maxima and Minima of a function of two independent variables, Jacobian, Taylor's Theorem and Taylor's series, Maclaurin's series, Binomial series.	**CO4-** Explain concept of jacobian of functionsand evaluate, calculate partial derivative of animplicit function usingjacobian, test the function for maxima and minima, illustrate expansion of functions using Maclaurin's series.
	Module 5	**Complex Numbers**	**COB5.** Understand powers and Roots of Exponential and Trigonometric Functions, expansion of $\sin^n\theta$, $\cos^n\theta$ in terms of sines and cosines of multiples of θ and expansion of sinnθ, cosnθ in powers of sinθ, cosθ, Circular functions of complex number and Hyperbolic functions, InverseCircular and Inverse Hyperbolic functions, Separation of real and imaginary parts of all types of Functions.	**CO5-** State complex numbers and list all the properties of it, calculate roots of an equation usingDe'Moivre's theorem, explain the expansion of trigonometric function, define hyperbolic functions, define inverse hyperbolic functions, identify the real and imaginary parts of complex expressions.
	Module 6	**Logarithm of Complex Numbers, Successive Differentiation**	**COB6.** Understand Logarithmic functions, Separation of real and Imaginary parts of Logarithmic Functions, successive differentiation: n^{th} derivative of standard functions, Leibnitz's Theorem.	**CO6–**Define logarithm of complex numbers, identify the real and imaginary parts of logarithmic expressions, definesuccessive differentiation and list standard formulae, determine nth order derivative of a function, state Leibnitz's theorem and problems on it, deduce n^{th} order derivative at x=0 usingLeibnitz's theorem.