MTS1 C01:MATHEMATICS-1

4 hours/week **3 Credits** **75 Marks[Int. 15 + Ext. 60]**

FIRST SEMESTER

Text (1)	Calculus I (2/e) : Jerrold Marsden & Alan Weinstein *Springer-Verlag New York Inc(1985) ISBN 0-387-90974-5*
Text (2)	Calculus II (2/e) : Jerrold Marsden & Alan Weinstein *Springer-Verlag New York Inc(1985) ISBN 0-387-90975-3*

Module I 14 hrs

1.1: Introduction to the derivative-instantaneous velocity, slope of tangent line, differentiating simplest functions

1.2: Limits- Notion of limit, basic properties, derived properties, continuity, continuity of rational functions, *one sided limit, limit involving* $\pm\infty$

1.3: The derivative as Limit- formal definition, *examples, differentiability and continuity*, Leibnitz notation,

1.4: Differentiating Polynomials-power rule, sum rule etc.,

1.5: Product and quotients- product, quotient, reciprocal & integral power rule

1.6: Linear Approximation and Tangent Lines- equation of tangent line and linear approximation, *illustrations*

Module II 13 hrs

2.1: Rate of change and Second derivative- linear or proportional change, rates of change, second derivative,

2.2: The Chain Rule- power of a function rule, chain rule,

2.3: Fractional Power & Implicit Differentiation-rational power of a function rule, implicit differentiation

2.4: Related rates and parametric curves- Related rates, parametric curves, *word problems involving related rates*

2.5: Anti derivatives- anti differentiation and indefinite integrals, anti differentiation rules

Module III 18 hrs

3.1: Continuity and Intermediate value theorem-IVT: first and second version

3.2: Increasing and decreasing function- Increasing and decreasing test, critical point test, first derivative test

3.3: Second derivative and concavity- second derivative test for local maxima , minima and concavity , inflection points

3.4: Drawing of Graphs- graphing procedure, *asymptotic behaviour*

3.5: Maximum- Minimum Problems- maximum and minimum values on intervals, extreme value theorem, closed interval test, *word problems*

3.6: The Mean Value Theorem- The MVT, consequences of MVT-*Rolles Theorem, horserace theorem*

11.2: L'Hospital rule- Preliminary version, strengthened version

Module IV 19 hrs

4.1: Summation- summation, *distance and velocity*, properties of summation, telescoping sum (quick introduction- relevant ideas only)

4.2: Sums and Areas-step functions, area under graph *and its counterpart in distance-velocity problem*

4.3: The definition of Integral- signed area *(The counterpart of signed area for our distance-velocity problem),* The integral, Riemann sums

4.4: The Fundamental Theorem of Calculus-*Arriving at FTC intuitively using distance velocity problem,* Fundamental integration Method, *proof of FTC,* Area under graph, displacements and velocity

4.5: Definite and Indefinite integral-indefinite integral test, properties of definite integral, fundamental theorem of calculus: alternative version *(interpretation and explanation in terms of areas)*

4.6: Applications of the Integral- Area between graphs, area between intersecting graphs, total changes from rates of change,

9.1: Volume by slice method- the slice method, volume of solid of revolution by Disk method

9.3: Average Values and the Mean Value Theorem for Integrals- *motivation and definition of average value, illustration, geometric and physical interpretation,* the Mean Value Theorem for Integrals

References:	
1	Soo T Tan: Calculus *Brooks/Cole, Cengage Learning(2010)ISBN 0-534-46579-X*
2	Gilbert Strang: Calculus *Wellesley Cambridge Press(1991)ISBN:0-9614088- 2-0*
3	Ron Larson. Bruce Edwards: Calculus(11/e) *Cengage Learning(2018) ISBN: 978-1-337-27534-7*
4	Robert A Adams & Christopher Essex : Calculus *Single Variable (8/e) Pearson Education Canada (2013) ISBN:* 0321877403
5	Joel Hass, Christopher Heil & Maurice D. Weir : Thomas' Calculus(14/e) *Pearson (2018) ISBN 0134438981*
6	Jon Rogawski & Colin Adams : Calculus *Early Transcendentals* (3/e) *W. H. Freeman and Company(2015) ISBN: 1319116450*

SECOND SEMESTER

MTS2 C02:MATHEMATICS-2

4 hours/week 3 Credits 75 Marks[Int. 15 + Ext. 60]

Text (1)	Calculus I (2/e) : Jerrold Marsden & Alan Weinstein *Springer-Verlag New York Inc(1985) ISBN 0-387-90974-5*
Text (2)	Calculus II (2/e) : Jerrold Marsden & Alan Weinstein *Springer-Verlag New York Inc(1985) ISBN 0-387-90975-3*
Text(3)	Advanced Engineering Mathematics(6/e) : Dennis G Zill *Jones & Bartlett Learning, LLC(2018)ISBN: 978-1-284-10590-2*

Module I Text (1) & (2) 18 hrs

5.1: Polar coordinates and Trigonometry – Cartesian and polar coordinates (*Only representation of points in polar coordinates, relationship between Cartesian and polar coordinates, converting from one system to another and regions represented by inequalities in polar system are required*)

5.3 : Inverse functions-inverse function test, inverse function rule

5.6: Graphing in polar coordinates- *Checking symmetry of graphs given in polar equation, drawings,* tangents to graph in polar coordinates

8.3: Hyperbolic functions- hyperbolic sine, cosine, tan etc., derivatives, anti differentiation formulas

8.4: Inverse hyperbolic functions- inverse hyperbolic functions *(their derivatives and anti derivatives)*

10.3: Arc length and surface area- Length of curves, Area of surface of revolution about x and y axes

10.4: Parametric curves- parametric equations of lines and circles, tangents to parametric curves, length of a parametric curve, speed

10.5: Length and area in polar coordinates- arc length and area in polar coordinates , *Area between two curves in polar coordinates*

Module II Text (2) 20 hrs

11.3: Improper integrals- integrals over unbounded intervals, comparison test, integrals of unbounded functions

11.4: Limit of sequences and Newton's method- □ − □ definition, limit of powers, comparison test, Newton's method

11.5: Numerical Integration- Riemann Sum, Trapezoidal Rule, Simpson's Rule

12.1: The sum of an infinite series- convergence of series, properties of limit of sequences (*statements only*), geometric series, algebraic rules for series, the □□ h term test

12.2: The comparison test and alternating series- comparison test, ratio comparison test, alternating series, alternating series test, absolute and conditional convergence

12.3: The integral and ratio test-integral test, p-series, ratio test, root test

12.4: Power series – ratio test for power series, root test, differentiation and integration of power series, algebraic operation on power series

12.5: Taylor's formula- Taylor and Maclaurian series, *Taylor's formula with remainder in integral form, Taylor's formula with remainder in derivative form,* convergence of Taylor series, Taylor series test, some important Taylor and Maclaurian series

Module III Text(3) 12 hrs

7.6: Vector spaces – *definition, examples , subspaces, basis, dimension, span*

7.6: Gram-Schmidt Orthogonalization Process- *orthonormal bases for* $\mathbb{R}^{□}$, construction of orthonomal basis of $\mathbb{R}^{□}$

8.2: Systems of Linear Algebraic Equations- General form, solving systems, augmented matrix, Elementary row operations, Elimination Methods- *Gaussian elimination, Gauss–Jordan elimination, row echelon form, reduced row echelon form, inconsistent system* , networks, homogeneous system, *over and underdetermined system*

8.3: Rank of a Matrix- *definition,* row space, rank by row reduction, rank and linear system, *consistency of linear system*

8.4: Determinants- *definition*, *cofactor* *(quick introduction)*

8.5: Properties of determinant- properties, *evaluation of determinant by* row reducing to triangular form

Module IV Text(3) 14 hrs

8.6: Inverse of a Matrix – finding inverse, properties *of inverse*, adjoint method, row operations method, using inverse to solve a linear system

8.8: The eigenvalue problem- Definition, *finding eigenvalues and eigenvectors*, complex eigenvalues, eigenvalues and singular matrices, eigenvalues of inverse

8.9: Powers of Matrices- *Cayley Hamilton theorem*, finding the inverse

8.10: Orthogonal Matrices- symmetric matrices and eigenvalues, inner product, *criterion for* orthogonal matrix, construction of orthogonal matrix

8.12:Diagonalization- diagonalizable matrix -*sufficient conditions*, orthogonal diagonalizability *of symmetric matrix*, Quadratic Forms

8.13: LU Factorization- d*efinition*, Finding an LU- factorization, Doolittlie method, solving linear systems *(by LU factorization)*, relationship to determinants

References:

1	Soo T Tan: Calculus *Brooks/Cole, Cengage Learning(2010) ISBN 0-534-46579-X*
2	Gilbert Strang: Calculus *Wellesley Cambridge Press(1991) ISBN:0-9614088-2-0*
3	Ron Larson. Bruce Edwards: Calculus(11/e) *Cengage Learning(2018) ISBN: 978-1- 337-27534-7*
4	Robert A Adams & Christopher Essex : Calculus *Single Variable (8/e) Pearson Education Canada (2013) ISBN:* 0321877403
5	Joel Hass, Christopher Heil & Maurice D. Weir : Thomas' Calculus(14/e) *Pearson (2018) ISBN 0134438981*
6	Peter V O'Neil: Advanced Engineering Mathematics(7/e) *Cengage Learning(2012) ISBN: 978-1-111-42741-2*
7	Erwin Kreyszig : Advanced Engineering Mathematics(10/e) *John Wiley & Sons(2011) ISBN: 978-0-470-45836-5*
8	Glyn James: Advanced Modern Engineering Mathematics(4/e) *Pearson Education Limited(2011) ISBN: 978-0-273-71923-6*

MATHEMATICS(COMPLEMENTARY COURSE)

THIRD SEMESTER

MAT3C03 : MATHEMATICS

5 hours/week 100marks 3 credits

Text :

1. **Erwin Kreyszig : Advanced Engineering Mathematics, Eighth Edition, Wiley, India.**
2. **Frank Ayres JR : Matrices, Schaum's Outline Series, TMH Edition.**

Module I : Ordinary Differential Equations (20 hrs)

Basic concepts and ideas, Geometrical meaning of y' = f(x,y). Direction fields, Separable Differential Equations. Exact differential Equations; Integrating Factors, Linear Differential Equations; Bernoulli Equation, Orthogonal Trajectories of Curves.

(Sections 1.1, 1.2, 1.3, 1.5, 1.6, 1.8 of Text 1).

Module II : Matrices (20 hrs)

Rank of a Matrix, Non- Singular and Singular matrices, Elementary Transformations, Inverse of an elementary Transformations, Row Canonical form, Normal form.

Systems of Linear equations: Homogeneous and Non Homogenoeus Equations, Characteristic equation of a matrix; Characteristic roots and characteristic vectors. Cayley- Hamilton Theorem (statement only) and simple applications **(relevant sections of Text 2)**.

Module III : Vector Differential Calculus (25 hrs)

A quick Review of vector algebra, Inner product and vector product in R^2 and R^3.Vector and scalar functions and Fields, Derivatives, Curves, Tangents, Arc Length, Velocity and acceleration, Gradient of a scalar field; Directional Derivative, Divergence of a vector field, Curl of a Vector Field.

(Sections 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.9, 8.10, 8.11 of Text 1).

Module IV : Vector Integral Calculus (25 hrs)

Line Integrals, Independence of path, Green's Theorem in the Plane (without proof), surfaces for Surface Integrals, Surface Integrals, Triple Integrals, Divergence theorem of Gauss and Stoke's theorem (without proofs).

(Sections 9.1, 9.2, 9.4, 9.5, 9.6, 9.7, 9.9, 9.10 of Text 1)

References :

1. S.S. Sastry, Engineering Mathematics, Volume II, 4th ed., PHI.
2. Shanthi Narayanan & P.K. Mittal, A Text Book of Matrices, S. Chand.
3. Harry F. Davis & Arthur David Snider, Introduction to Vector Analysis, 6th ed., Universal Book Stall, New Delhi.
4. Murray R. Spiegel, Vector Analysis, Schaum's Outline Series, Asian Student edition.

MATHEMATICS(COMPLEMENTARY COURSE)

FOURTH SEMESTER

MAT4C04 : MATHEMATICS

5 hours/week 100marks 3 credits

Texts:

4 **Erwin Kreyszig, Advanced Engineering Mathematics, Eighth Edition, Wiley, India.**

5 **George B. Thomas, Jr. and Ross L. Finney, Calculus, LPE, Ninth Edition, Pearson Educatio**n.

Module I: Linear Differential equations of Second and Higher order (20hrs)

Linear Differential equations of Second and Higher order: Differential Operators, Euler- Cauchy Equation, Wronskian, Nonhomogeneous Equations, Solutions by Undetermined Coefficients, Solution by variation of Parameters.

(Sections 2.1, 2.2, 2.3, 2.4, 2.6, 2.7, 2.8, 2.9, 2.10 of Text 1).

Module II: **Laplace Transforms (20 hrs)**

Laplace Transforms: Laplace Transform, Inverse Transform, Linearity, Shifting, Transforms of Derivatives of Integrals, Differential Equations. Unit step Function, Second Shifting Theorem, Dirac Delta Function, Differentiation and integration of Transforms, Convolution, Integral Equations, Partial Fractions, Differential Equations.

(Sections 5.1, 5.2, 5.3, 5.4, 5.5, 5.6 of Text 1 – excluding Proofs).

Module III : Fourier Series ,Partial differential Equations(30 hrs)

Fourier Series : Periodic Functions, Trigonometric Series, Fourier Series, Even and Odd functions, Half- range Expansions.

(Sections 10.1, 10.2, 10.4 of Text 1 – Excluding Proofs).

Partial differential Equations: Basic Concepts, Vibrating String, Wave Equation, Separation of Variables, Use of Fourier Series.

(sections 11.1, 11.2, 11.3 of Text 1).

Module IV:Numerical Methods (20 hrs)

Numerical Methods: Methods of First- order Differential Equations (Section 19.1 of Text 1). Picard's iteration for initial Value Problems.(Section 1.9 of Text 1).

Numerical Integration: Trapezoidal Rule, Simpson's Rule. (Section 4.9 of Text 2).

References:

3 S.S. Sastry, Engineering Mathematics, Vol. II, 4th ed., PHI.

4 Murray R. Spiegel, Advanced Calculus, Schaum's Outline Series.

5 Murray R. Spiegel, Laplace Transforms, Schaum's Outline Series