# SRM Institute of Science and Technology

**College of Engineering and Technology**

**Department of Mathematics**

**21MAB101T- CALCULUS AND LINEAR ALGEBRA**

**Academic Year - 2023-2024**

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| **Unit-1: Matrices** | |
| 1 | Characteristic equation, Eigen values and Eigen vectors. |
| 2 | Eigen values and Eigen vectors-problems. |
| 3 | Properties of Eigen values-problems. |
| 4 | **Problem-solving using tutorial sheet 1** |
| 5 | Cayley - Hamilton theorem - Verification. |
| 6 | Finding $A^{-1}$ and finding higher powers of A using Cayley – Hamilton theorem. |
| 7 | Orthogonal matrices - Properties of Orthogonal matrices. |
| 8 | **Problem-solving using tutorial sheet 2** |
| 9 | Orthogonal reduction of a symmetric matrix to a diagonal form. |
| 10 | Reduction of Quadratic form to Canonical form by orthogonal transformation. |
| 11 | Discuss the nature of the Quadratic Form to Canonical form without reduction. |
| 12 | **Problem-solving using tutorial sheet 3** |
| **Unit-2: Functions of several variables** | |
| 13 | Functions of two variables – Total differential. |
| 14 | Partial derivatives. |
| 15 | Taylor's series expansion with two variables up to third-order terms. |
| 16 | **Problem-solving using tutorial sheet 4** |
| 17 | Maxima and Minima. |
| 18 | Maxima and Minima- Problems. |
| 19 | Constrained Maxima and Minima by Lagrangian Multiplier Method. |
| 20 | **Problem-solving using tutorial sheet 5** |
| 21 | Constrained Maxima and Minima by Lagrangian Multiplier Method – Problems. |
| 22 | Jacobians - Problems |
| 23 | Properties of Jacobians – Problems. |
| 24 | **Problem-solving using tutorial sheet 6** |
| **Unit-3: Ordinary differential equations** | |
| 25 | Linear equations of second order with constant coefficients -Type-1- PI= $e^{ax}$<br>Type-2- PI=sin ax or cos ax. |
| 26 | Type-3 -$x^n$ (polynomial) , Type-4-PI= -$x^n$ f(x) , (f(x)=sin ax or cos ax or $x^n$) |
| 27 | Type-5- PI=x sin ax or x cos ax. |
| 28 | **Problem-solving using tutorial sheet 7** |
| 29 | Linear equations of second order with variable coefficients-Homogeneous equation of Euler type. |
| 30 | Homogeneous equation of Euler type – Problems. |
| 31 | Homogeneous equation of Legendre's Type – Problems. |
| 32 | **Problem-solving using tutorial sheet 8** |
| 33 | Method of Variation of parameters. |

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| 34 | Simultaneous first-order differential equations with constant coefficients. |
| 35 | Simultaneous first-order differential equations with constant coefficients – Problems. |
| 36 | **Problem-solving using tutorial sheet 9** |
| **Unit-4: Differential Calculus and Beta Gamma functions** | |
| 37 | Radius of Curvature – Cartesian coordinates. |
| 38 | Radius of Curvature – Polar coordinates. |
| 39 | Centre of curvature. |
| 40 | **Problem - solving using tutorial sheet 10** |
| 41 | Circle of curvature. |
| 42 | Evolute of standard curves – Problems. |
| 43 | Evolute of standard curves continuation. |
| 44 | **Problem- solving using tutorial sheet 11** |
| 45 | Envelope of standard curves. |
| 46 | Beta Gamma Functions - Definitions. |
| 47 | Beta Gamma Functions - simple problems. |
| 48 | **Problem - solving using tutorial sheet 12** |
| **Unit-5: Sequences and series** | |
| 49 | Sequences – Definition and Examples. |
| 50 | Series – Types of Convergence. |
| 51 | Test of Convergence- Comparison test. |
| 52 | **Problem - solving using tutorial sheet 13** |
| 53 | Test of Convergence - D'Alembert's Ratio test. |
| 54 | Raabe's root test – Problems. |
| 55 | Test of Convergence - Cauchy's Root test. |
| 56 | **Problem - solving using tutorial sheet 14** |
| 57 | Alternating Series: Leibnitz test. |
| 58 | Alternating Series: Logarithmic Test. |
| 59 | Alternating Series: Absolute Convergence- Conditional Convergence. |
| 60 | **Problem-solving using tutorial sheet 15** |

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