**Course Learning Syllabus** (// includes Learning Outcomes & Learning Plan & Assessment Plan)

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| **Course Code** | 18MAB101T | **Course Name** | **CALCULUS AND LINEAR ALGEBRA** | **Course Category** | BS | Basic Sciences | L | T | P | C |
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| **Pre-requisite Courses** | Nil | **Co-requisite Courses** | Nil | **Progressive Courses** | Nil |
| **Course Offering Department** | Mathematics | | **Data Book / Codes / Standards** | | Nil |

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| **Course Learning Rationale (CLR):** | The purpose of learning this course is to: | **Learning** | | |  | **Program Learning Outcomes (PLO)** | | | | | | | | | | | | | | |
| **CLR – 1:** | Application of Matrices in problems of Science and Engineering | 1 | 2 | 3 |  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| **CLR – 2:** | To apply the concept of Taylor series, Maxima Minima, Composite function and Jacobian in problems of science and Engineering | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) |  | Engineering Knowledge | Problem Analysis | Design & Development | Analysis, Design, Research | Modern Tool Usage | Society & Culture | Environment & Sustainability | Ethics | Individual & Team Work | Communication | Project Mgt. & Finance | Life Long Learning | PSO - 1 | PSO - 2 | PSO - 3 |
| **CLR – 3:** | To apply the concept of Differential Equations in problems of Science and Engineering |
| **CLR – 4:** | To apply the concepts of radius of curvature, evolute, envelope in problems of Science and Engineering |
| **CLR – 5:** | Application of Sequences and Series in all problems involving Science and Engineering |
| **Course Learning Outcomes (CLO):** | At the end of this course, learners will be able to: |
| **CLO – 1:** | Apply the Knowledge of Matrices, Eigen values and Eigen Vectors, Reduce to Quadratics form in problems involving Science and Engineering | 2 | 85 | 80 |  | L |  | L |  |  |  |  |  | M |  |  | H |  |  |  |
| **CLO – 2:** | Gain familiarity in the knowledge of Maxima and Minima, Jacobian and Taylor series and apply them in the problems involving Science and Engineering | 2 | 85 | 80 |  | L |  |  | M | M |  |  |  |  |  |  |  |  |  |  |
| **CLO – 3:** | Gain knowledge in solution of Differential Equations and its applications in engineering problems | 2 | 85 | 80 |  |  | M |  |  |  |  |  |  | M |  |  | H |  |  |  |
| **CLO – 4:** | To gain the knowledge of Radius, Centre, envelope and Circle of curvature and apply them in the problems involving Science and Engineering | 2 | 85 | 80 |  | L | M |  | M |  |  |  |  | M |  |  | H |  |  |  |
| **CLO – 5:** | Gain the knowledge of convergence and divergence of series using different test and apply sequence and series in the problems involving Science and Engineering | 2 | 85 | 80 |  |  | M | L |  |  |  |  |  | M |  |  | H |  |  |  |

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| ***Duration 12 Hours*** | | ***Learning Unit / Module 1*** | ***Proposed Date & Hour*** | ***Conducted Date & Hour*** | ***Remarks*** |
| *S-1* | *SLO-1* | Characteristic equation |  |  |  |
| *SLO-2* | Eigen values of a real matrix |  |  |  |
| *S-2* | *SLO-1* | Eigen vectors of a real matrix |  |  |  |
| *SLO-2* | Eigen vectors of a real matrix |  |  |  |
| *S-3* | *SLO-1* | Properties of Eigen values |  |  |  |
| *SLO-2* | Cayley-Hamilton theorem |  |  |  |
| *S-4* | *SLO-1* | Problem solving using Tutorial Sheet – 1 |  |  |  |
| *SLO-2* | Problem solving using Tutorial Sheet – 1 |  |  |  |
| *S-5* | *SLO-1* | Finding A inverse using Cayley-Hamilton theorem |  |  |  |
| *SLO-2* | *Finding higher powers of A using Cayley-Hamilton theorem* |  |  |  |
| *S-6* | *SLO-1* | *Orthogonal reduction of a symmetric matrix to diagonal form* |  |  |  |
| *SLO-2* | *Orthogonal reduction of a symmetric matrix to diagonal form* |  |  |  |
| *S-7* | *SLO-1* | *Orthogonal reduction of a symmetric matrix to diagonal form* |  |  |  |
| *SLO-2* | *Orthogonal reduction of a symmetric matrix to diagonal form* |  |  |  |
| *S-8* | *SLO-1* | Problem solving using Tutorial Sheet – 2 |  |  |  |
| *SLO-2* | Problem solving using Tutorial Sheet – 2 |  |  |  |
| *S-9* | *SLO-1* | *Reduction of Quadratic form to Canonical form* |  |  |  |
| *SLO-2* | *Quadratic form to Canonical form by orthogonal transformations* |  |  |  |
| *S-10* | *SLO-1* | *Quadratic form to Canonical form by orthogonal transformations* |  |  |  |
| *SLO-2* | *Orthogonal matrices* |  |  |  |
| *S-11* | *SLO-1* | *Reduction of Quadratic form to Canonical form* |  |  |  |
| *SLO-2* | *Reduction of Quadratic form to Canonical form* |  |  |  |
| *S-12* | *SLO-1* | Problem solving using Tutorial Sheet – 3 |  |  |  |
| *SLO-2* | *Applications of Matrices in Engineering* |  |  |  |
| ***Duration 12 Hours*** | | ***Learning Unit / Module 2*** | ***Proposed Date & Hour*** | ***Conducted Date & Hour*** | ***Remarks*** |
| *S-1* | *SLO-1* | Function of two variables – Partial derivatives |  |  |  |
| *SLO-2* | Total differential |  |  |  |
| *S-2* | *SLO-1* | Total differential |  |  |  |
| *SLO-2* | Taylor’s expansion with two variables upto second order terms |  |  |  |
| *S-3* | *SLO-1* | Taylor’s expansion with two variables upto third order terms |  |  |  |
| *SLO-2* | Maxima and Minima |  |  |  |
| *S-4* | *SLO-1* | Problem solving using Tutorial Sheet – 4 |  |  |  |
| *SLO-2* | Problem solving using Tutorial Sheet – 4 |  |  |  |
| *S-5* | *SLO-1* | Maxima and Minima |  |  |  |
| *SLO-2* | Maxima and Minima |  |  |  |
| *S-6* | *SLO-1* | Maxima and Minima |  |  |  |
| *SLO-2* | *Constrained Maxima and Minima by Lagrangian Multiplier Method* |  |  |  |
| *S-7* | *SLO-1* | *Constrained Maxima and Minima by Lagrangian Multiplier Method* |  |  |  |
| *SLO-2* | *Constrained Maxima and Minima by Lagrangian Multiplier Method* |  |  |  |
| *S-8* | *SLO-1* | Problem solving using Tutorial Sheet – 5 |  |  |  |
| *SLO-2* | Problem solving using Tutorial Sheet – 5 |  |  |  |
| *S-9* | *SLO-1* | *Jacobians of two variables* |  |  |  |
| *SLO-2* | *Jacobians of three variables* |  |  |  |
| *S-10* | *SLO-1* | *Jacobians problems* |  |  |  |
| *SLO-2* | *Jacobians problems* |  |  |  |
| *S-11* | *SLO-1* | *Properties of Jacobians and problems* |  |  |  |
| *SLO-2* | *Properties of Jacobians and problems* |  |  |  |
| *S-12* | *SLO-1* | *Application of Taylor’s series, Maxima Minima, Jacobians in Engineering* |  |  |  |
| *SLO-2* | *Application of Taylor’s series, Maxima Minima, Jacobians in Engineering* |  |  |  |
| ***Duration 12 Hours*** | | ***Learning Unit / Module 3*** | ***Proposed Date & Hour*** | ***Conducted Date & Hour*** | ***Remarks*** |
| *S-1* | *SLO-1* | Linear equations of second order with constant coefficients when PI = 0 or exponential |  |  |  |
| *SLO-2* | Linear equations of second order with constant coefficients when PI = sin a x or cos a x |  |  |  |
| *S-2* | *SLO-1* | Linear equations of second order with constant coefficients when PI = polynomial |  |  |  |
| *SLO-2* | Linear equations of second order with constant coefficients when PI = exponential with sin a x or cos a x |  |  |  |
| *S-3* | *SLO-1* | Linear equations of second order with constant coefficients when PI = exponential with poynomial |  |  |  |
| *SLO-2* | Linear equations of second order with constant coefficients when PI = polynomial with sinh a x or cosh a x |  |  |  |
| *S-4* | *SLO-1* | Problem solving using Tutorial Sheet – 6 |  |  |  |
| *SLO-2* | Problem solving using Tutorial Sheet – 6 |  |  |  |
| *S-5* | *SLO-1* | Linear equations of second order with variable coefficients |  |  |  |
| *SLO-2* | Linear equations of second order with variable coefficients |  |  |  |
| *S-6* | *SLO-1* | *Homogeneous equation of Euler type* |  |  |  |
| *SLO-2* | *Homogeneous equation of Legendre’s type* |  |  |  |
| *S-7* | *SLO-1* | *Homogeneous equation of Legendre’s type* |  |  |  |
| *SLO-2* | *Equations reducible to homogeneous form* |  |  |  |
| *S-8* | *SLO-1* | Problem solving using Tutorial Sheet – 7 |  |  |  |
| *SLO-2* | Problem solving using Tutorial Sheet – 7 |  |  |  |
| *S-9* | *SLO-1* | *Equations reducible to homogeneous form* |  |  |  |
| *SLO-2* | *Variation of parameters* |  |  |  |
| *S-10* | *SLO-1* | *Variation of parameters* |  |  |  |
| *SLO-2* | *Simultaneous first order with constant coefficient* |  |  |  |
| *S-11* | *SLO-1* | *Simultaneous first order with constant coefficient* |  |  |  |
| *SLO-2* | *Simultaneous first order with constant coefficient* |  |  |  |
| *S-12* | *SLO-1* | Problem solving using Tutorial Sheet – 8 |  |  |  |
| *SLO-2* | *Application of differential equation in Engineering* |  |  |  |
| ***Duration 12 Hours*** | | ***Learning Unit / Module 4*** | ***Proposed Date & Hour*** | ***Conducted Date & Hour*** | ***Remarks*** |
| *S-1* | *SLO-1* | Radius of curvature – Cartesian coordinates |  |  |  |
| *SLO-2* | Radius of curvature – Cartesian coordinates |  |  |  |
| *S-2* | *SLO-1* | Radius of curvature – Polar coordinates |  |  |  |
| *SLO-2* | Radius of curvature – Polar coordinates |  |  |  |
| *S-3* | *SLO-1* | Circle of curvature |  |  |  |
| *SLO-2* | Circle of curvature |  |  |  |
| *S-4* | *SLO-1* | Problem solving using Tutorial Sheet – 9 |  |  |  |
| *SLO-2* | Application of Radius of curvature in Engineering |  |  |  |
| *S-5* | *SLO-1* | Centre of curvature |  |  |  |
| *SLO-2* | *Centre of curvature* |  |  |  |
| *S-6* | *SLO-1* | *Centre of curvature* |  |  |  |
| *SLO-2* | *Evolute of a parabola* |  |  |  |
| *S-7* | *SLO-1* | *Evolute of an ellipse* |  |  |  |
| *SLO-2* | *Envelope of standard curves* |  |  |  |
| *S-8* | *SLO-1* | Problem solving using Tutorial Sheet – 10 |  |  |  |
| *SLO-2* | *Application of curvature in Engineering* |  |  |  |
| *S-9* | *SLO-1* | *Beta Gamma functions* |  |  |  |
| *SLO-2* | *Beta Gamma functions and their properties* |  |  |  |
| *S-10* | *SLO-1* | *Sequences – Definition and Examples* |  |  |  |
| *SLO-2* | *Series – Types of convergence* |  |  |  |
| *S-11* | *SLO-1* | *Series of positive terms – Test of convergence* |  |  |  |
| *SLO-2* | *Comparison test – Integral test* |  |  |  |
| *S-12* | *SLO-1* | Problem solving using Tutorial Sheet – 11 |  |  |  |
| *SLO-2* | Problem solving using Tutorial Sheet – 11 |  |  |  |
| ***Duration 12 Hours*** | | ***Learning Unit / Module 5*** | ***Proposed Date & Hour*** | ***Conducted Date & Hour*** | ***Remarks*** |
| *S-1* | *SLO-1* | *Series of positive terms – Test of convergence* |  |  |  |
| *SLO-2* | *Comparison test – Integral test* |  |  |  |
| *S-2* | *SLO-1* | *Comparison test – Integral test* |  |  |  |
| *SLO-2* | *Comparison test – Integral test* |  |  |  |
| *S-3* | *SLO-1* | D’Alembert’s Ratio test |  |  |  |
| *SLO-2* | D’Alembert’s Ratio test |  |  |  |
| *S-4* | *SLO-1* | Problem solving using Tutorial Sheet – 12 |  |  |  |
| *SLO-2* | Problem solving using Tutorial Sheet – 12 |  |  |  |
| *S-5* | *SLO-1* | Raabe’s root test |  |  |  |
| *SLO-2* | *Raabe’s root test* |  |  |  |
| *S-6* | *SLO-1* | *Convergent of Exponential series* |  |  |  |
| *SLO-2* | *Cauchy’s root test* |  |  |  |
| *S-7* | *SLO-1* | *Log test* |  |  |  |
| *SLO-2* | *Log test* |  |  |  |
| *S-8* | *SLO-1* | Problem solving using Tutorial Sheet – 13 |  |  |  |
| *SLO-2* | Problem solving using Tutorial Sheet – 13 |  |  |  |
| *S-9* | *SLO-1* | *Alternating series: Leibnitz test* |  |  |  |
| *SLO-2* | *Alternating series: Leibnitz test* |  |  |  |
| *S-10* | *SLO-1* | *Series of positive and negative terms* |  |  |  |
| *SLO-2* | *Series of positive and negative terms* |  |  |  |
| *S-11* | *SLO-1* | *Absolute convergence* |  |  |  |
| *SLO-2* | *Conditional convergence* |  |  |  |
| *S-12* | *SLO-1* | Problem solving using Tutorial Sheet – 14 |  |  |  |
| *SLO-2* | *Applications of Convergence of series in Engineering* |  |  |  |
| *Learning Resources* | | 1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006. 2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010. 3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008. 4. Ramana B. V., Higher Engineering Mathematics, Tata McGraw Hill, New Delhi, 11th Reprint, 2010. 5. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002. 6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008. | | |  |

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|  | **Level of Thinking** | **Continuous Assessment** | | | Final Examination (40%) |
| CA – 1 (20%) | CA – 2 (20%) | CA – 3 (20%) # |
| Level 1 | Remember | 40 % | 30 % | 30 % | 30 % |
| Understand |
| Level 2 | Apply | 40 % | 40 % | 40 % | 40 % |
| Analyze |
| Level 3 | Evaluate | 20 % | 30 % | 30 % | 30 % |
| Create |

*# CA – 3 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,*

*SLO – Session Learning Outcome*

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| *Course Designers* | | | | | | | |
| *(a) Experts from Industry* | | | | | | | |
| *1* | *Mr.V.Maheshwaran* | *CTS, Chennai* | *maheshwaran*[*v @yahoo.com*](mailto:v@yahoo.com) |  |  |  |  |
| *(b) Experts from Higher Technical Institutions* | | | | | | | |
| *3* | *Dr.K.C.Sivakumar* | *IIT, Madras* | *kcskumar@iitm .ac.in* | *4* | *Dr.Nanjundan* | *Bangalore University* | *nanzundan@gmail*  *.com* |
| *(b) Internal Experts* | | | | | | | |
| *5* | *Dr.A.Govindarajan* | *SRMIST* | *govindarajan.a @ktr.srmuniv*  *.ac.in* | *6* | *Dr.Srinivasan* | *SRMIST* | *srinivasan.va@ srmuniv.ac.in* |

To emerge as a World - Class University in creating and disseminating knowledge, and providing students a unique learning experience in Science, Technology, Medicine, Management and other areas of scholarship that will best serve the world and betterment of mankind.

MOVE UP through international alliances and collaborative initiatives to achieve global excellence. ACCOMPLISH A PROCESS to advance knowledge in a rigorous academic and research environment.

ATTRACT AND BUILD PEOPLE in a rewarding and inspiring environment by fostering freedom, empowerment, creativity and innovation.