BLOW UP SYLLABUS

(Effective from the academic year 2025-26)

Course Title: **Calculus, Laplace Transforms and Numerical Techniques**

Course Code: **1BMATE201**

Topics	**Topics To be Covered**	**Remarks**
Module-1: Integral Calculus and its applications (8 Hours Theory + 4 Hours Tutorial)		
Multiple Integrals: Evaluation of double and triple integrals, change of order of integration, changing to polar coordinates. Areas and volume using double integration. Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions. **Text Book-1: Chapter-7.1, 7.2, 7.3, 7.4, 7.5, 7.6(1), 7.14, 7.15, 7.16.**	No Change	No questions shall be asked in the SEE (Semester End Examination) on the *construction of limits using region statement*.
Module-2: Vector calculus and its applications (8 Hours Theory + 4 Hours Tutorial)		
Vector differentiation: Scalar and vector fields, gradient of a scalar field, directional derivatives, divergence of a vector field, solenoidal vector, curl of a vector field, irrotational vector, physical interpretation of gradient, divergence and curl and scalar potential. Vector Integration**:** Line integrals, Statement of Green's and Stokes' theorem without verification problems. Text Book-1: Chapter-8.4, 8.5, 8.6, 8.7, 8.11, 8.13,8.14	No Change	No verification problems on Green's and Stokes' theorem
Module-3: Numerical Methods-1 (8 Hours Theory + 4 Hours Tutorial)		
Solution of algebraic and transcendental equations: Regula-Falsi method, and Newton-Raphson method. Finite Differences and Interpolation: Forward and backward differences, Interpolation, Newton forward and backward interpolation formulae, Newton's divided difference interpolation formula and Lagrange's interpolation formula. Numerical Integration: Trapezoidal rule, Simpson's 1/3rd rule and Simpson's 3/8th rule. Text Book-1: Chapter-28.1, 28.2(2,3), 29.1(1,2), 29.6(1,2), 29.9, 29.10, 29.11, 29.12, 30.4, 30.6, 30.7, 30.8.		No problems on Inverse Lagrange's Interpolation
Module-4: Numerical Methods-2 (8 Hours Theory + 4 Hours Tutorial)		
Numerical solution of ordinary differential equations of first order and first degree: Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order, Milne's predictor corrector method and Adam-Bashforth predictor-corrector method. Text Book-1: Chapter-32.1, 32.3, 32.5, 32.6, 32.7,32..8, 32.9, 32.10.		Problems on Runge-Kutta method of fourth order restricted to one stage only.

Module-5: Laplace transforms	**(8 Hours Theory + 4 Hours Tutorial)**	
Laplace transforms: Definition and Formulae of Laplace Transforms, Laplace Transforms of elementary functions. Properties–Linearity, Scaling, shifting property, differentiation in the s domain, division by t. Laplace Transforms of periodic functions, square wave, saw-tooth wave, triangular wave, full and half wave rectifier, Heaviside Unit step function. Inverse Laplace Transforms: Definition, properties, evaluation of Inverse Laplace Transforms using different methods, and applications to solve ordinary differential equations. Text Book-1: Chapter-21.1, 21.2, 21.3, 21.4(I,II,III), 21.5, 21.9, 21.10, 21.12, 21.13, 21.15, 21.17.	No derivations on LT of elementary functions. Only problems on Properties. No Derivation on LT of periodic function.	

Suggested Learning Resources: (Textbook/ Reference Book):

Textbooks:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2021.
2. E. Kreyszig, Advanced Engineering Mathematics, JohnWiley & Sons, 10th Ed.,2018.
3. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, 8th Ed., 2022.

Reference books:

1. B. V. Ramana, Higher Engineering Mathematics, McGraw-HillEducation,11thEd., 2017
2. Srimanta Pal & Subodh C. Bhunia, Engineering Mathematics, Oxford University Press, 3rd Ed., 2016.
3. N. P. Bali and Manish Goyal, A Text book of Engineering Mathematics, Laxmi Publications,10thEd.,2022.
4. H. K. Das and Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand Publication, 3rd Ed., 2014.
5. Steven V. Chapra and Raymond P. Canale, Applied Numerical Methods with Matlab for Engineers and Scientists, McGraw-Hill, 3rdEd., 2011.
6. Richard L. Burden, Douglas J. Faires and A. M. Burden, Numerical Analysis, 10th Ed., 2010, Cengage Publishers.
7. S.S. Sastry," Introductory Methods of Numerical Analysis", PHI Learning Private Limited, 5thEd.,2012.