BLOW UP SYLLABUS Differential Calculus and Linear Algebra

for First year Civil Engineering (1BMATM101) (Effective from the academic year 2025-26)

Topics	Topics To be Covered	Remarks
Module-1: Polar Curves and Curvature		
Polar coordinates, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations. Curvature and radius of curvature - Cartesian, parametric, polar and pedal forms, Problems	Discussion and coverage of contents as suggested in the topic. (No derivation on curvature in any form)	
Module-2: Series Expansion, Indeterminate Forms and Multivariable Calculus		
Statement and problems on Taylor's and Maclaurin's series expansion for one variable. Indeterminate forms - L'Hospital's rule. Partial differentiation, total derivative - differentiation of composite functions, Jacobian, Maxima and minima for the function of two variables.	In Indeterminate forms - L'Hospital's rule. Problems restricted to $(\infty-\infty)$, 1^{∞} , 0^{∞} ∞^{0}, No verification on Jacobian $JJ^{1} = 1$	No Problems set on Taylor's series
Module-3: Ordinary Differential Equations of First Order		
Linear and Bernoulli's differential equation. Exact and reducible to exact differential equations with integrating factors - $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ **and** $\frac{1}{M}\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$**.** Orthogonal trajectories**,** Law of natural growth and decay**.**		No Problems set on Linear and Exact differential equations in the final examination.
Module-4: Linear Algebra -1		
Elementary row transformation of a matrix, Row echelon form and Rank of a matrix. Inverse of matrix by Jordan method. Consistency and Solution of system of linear equations - Gauss-elimination method, LU decomposition method and approximate solution by Gauss-Seidel method. Application to	No change	

traffic flow.		
Module-5: Linear Algebra		
Eigenvalues and Eigenvectors, Rayleigh's power method to find the dominant Eigenvalue and Eigenvector. Model matrix, Diagonalization of the matrix, inverse of a matrix by Cayley-Hamilton theorem, Characteristic and minimal polynomials of block matrices, Moore-Penrose pseudoinverse.	No Change	

Suggested Learning Resources: (Textbook/Reference Book):

Textbooks:

1. B.S. Grewal, HigherEngineeringMathematics, KhannaPublishers,44th Ed., 2021.
2. E.Kreyszig, AdvancedEngineeringMathematics,JohnWiley&Sons,10th Ed.,2018.
3. GilbertStrang, LinearAlgebraanditsApplications,CengagePublications,4thEd.,2022.

Reference books:

1. B.V.Ramana, HigherEngineeringMathematics,McGraw-HillEducation,11thEd., 2017
2. Srimanta Pal & Subodh C.Bhunia, Engineering Mathematics, Oxford University Press, 3rd Ed., 2016.
3. N. P.BaliandManishGoyal, ATextbookofEngineeringMathematics,Laxmi Publications,10thEd.,2022.
4. H.K.DassandEr.RajnishVerma, HigherEngineeringMathematics,S.Chand Publication, 3rd Ed., 2014.
5. DavidCLay, LinearAlgebraanditsApplications, PearsonPublishers, 4thEd., 2018.