NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B.Tech. (Chemical Engineering)
Course Code:	2CH801CC23
Course Title:	Mathematics for Chemical Engineering
Course Type:	Core
Year of introduction:	2023-2024

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Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. solve differential equations in the field of chemical engineering (BL3)
2. interpret initial value problems using Laplace transformation (BL2)
3. apply numerical techniques to solve chemical engineering problems (BL3)
4. prove finite difference method usage in chemical engineering (BL4)

	Contents	**Teaching Hours (Total 30)**
Unit I	**Ordinary Differential Equations:** Higher order linear differential equations with constant coefficient, Complementary functions and particular integral, Method of variation of parameters, Equations reducible to linear equations with a constant coefficient (Cauchy's and Legendre's linear equations), Simultaneous linear equations with constant coefficient, Application in chemical engineering	09
Unit II	**Laplace Transforms**: Definition, Linearity property, Laplace transforms of elementary functions, shifting theorem, Inverse Laplace transforms, Laplace of differentiation and integration, Convolution theorem, application of Laplace transforms in solving ordinary differential equations, Laplace transforms of periodic, Unit step, impulse, ramp and sinusoidal functions.	06
Unit III	**Numerical Methods:** Solution of algebraic and transcendental equations by Bisection and Newton-Raphson iteration methods, Finite differences, Interpolation, Finite difference operators, Newton's forward interpolation, Newton's backward interpolation, Lagrange's interpolation, Numerical differentiation, Numerical integration by Trapezoidal rule, Simpson's 1/3rd rule, Simpson's 3/8th rule	09
Unit IV	**Numerical Solutions of Differential Equations**: Solution of first order differential equations: Taylor series method, Euler's method, 4th order Runge–Kutta method, Finite difference method to solve differential equations	06

Tutorial Works:
Tutorial work will be based on the above syllabus, with minimum 10 tutorials to be incorporated.

Self-Study:
Self-study contents will be declared at the commencement of the semester. Around 10 % of the questions will be asked from the self-study contents.

Suggested Readings/ References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Eastern Publications.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications.
3. S. C. Chapra and R. P. Canale, Numerical Methods for Engineers with Programming and Software Applications, McGraw-Hill Publications.
4. M. K. Jain and S R K Iyengar Numerical Methods for Scientific & Engineering Computation, New age International Publication.
5. S C Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics: S Chand.
6. Jay I. Devore, Probability and Statistics for Engineers and Scientists; Pearson.