NIRMA UNIVERSITY

Institute:	**Institute of Technology**
Name of Programme:	**B Tech in Civil Engineering**
Course Code:	2CL801
Course Title:	**Mathematics for Civil Engineers**
Course Type:	(☑Core/□Value Added Course/□Departmental Elective/ □Institute Elective/□University Elective/(□Open Elective Any other)
Year of Introduction:	2023-24

L	**T**	**Practical Component**				**C**
		LPW	**PW**	**W**	**S**	
2	**-**	**2**	**-**	**-**	**-**	**3**

Course Learning Outcomes (CLOs):

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

1. apply Fourier series for representing periodic functions (BL3)
2. solve real life applications of differential equations (BL3)
3. analyse Civil Engineering problems using numerical methods (BL4)
4. demonstrate computer applications for Civil Engineering problems. (BL2)

Syllabus: **Total Teaching hours:30**

Unit	**Syllabus**	**Teaching hours**
Unit-I	**Fourier Series** Periodic functions. Euler's formulae. Fourier expansion of periodic functions with period 2π. Dirichlet's conditions. Fourier series of even and odd functions. Fourier series of periodic functions with arbitrary periods.	06
Unit-II	**Differential Equations** Higher order ordinary differential equations with constant coefficients, Complementary function and particular integral, Boundary Value Problem, Initial Value Problem, Solution of partial differential equations, method of separation of variable, wave and Laplace equation, Applications of differential equations in Civil Engineering.	12
Unit-III	**Numerical Methods** Iterative Method: Motivation, errors, truncation error, rounded off error, absolute error, relative error and percentage error, Solution of algebraic and transcendental equation by False position, Newton-Raphson iteration, Rate of convergence of the iteration methods, Comparisons of iterative methods. System of Linear Algebraic Equations: Gauss-Seidel iteration method. Finite Differences and Interpolation: Newton's forward and backward interpolation and Lagrange's interpolation.	12

Numerical Differentiation and Integration: Numerical differentiation, Numerical integration: Trapezoidal rule, Simpson's 1/3rd rule, Simpson's 3/8th rule.
Numerical solution of differential equation: Euler's Method, Runge-kutta method of 4^{th} order, Finite Difference Method.

Self-Study:	The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study contents.
Suggested Readings/ References:	● Veerarajan, T, *Engineering Mathematics*, McGraw-Hill. ● Grewal, B. S., *Higher Engineering Mathematics*, Khanna Publishers. ● Kreyszig, E., *Advanced Engineering Mathematics*, John Wiley & Sons. ● Boyce, W. E. & DiPrima, R. C., *Elementary Differential Equations and Boundary Value Problems*, Wiley India. ● Simmons, G. F. & Krantz, S. G., *Differential Equations*, McGraw Hill. ● Chapra, S. C. & Canale, R. P., *Numerical methods for Engineers*, McGraw-Hill.
Suggested List of Experiments:	Laboratory work will be based on above syllabus incorporating the exercise using C programming and other programming languages.

Sr. No.	Name of Experiments/Exercises	Hours
1.	Numerical iteration methods-False Position	02
2.	Numerical iteration methods-Newton Rapson	04
3.	Solution of system of linear algebraic equation using Gauss Seidel method	04
4.	Newton's forward interpolation	02
5.	Newton's backward interpolation	02
6.	Lagrange's interpolation	02
7.	Numerical differentiation	04
8.	Numerical integration	02
9.	Numerical solution of ODE using 4th order Runge-Kutta method	04
10.	Numerical solution of PDE using finite difference method	04