NIRMA UNIVERSITY

Institute:	**Institute of Technology**
Name of Programme:	**B. Tech. in Electrical Engineering**
Semester:	**III**
Course Code:	**2EE801**
Course Title:	**Mathematical Applications in Electrical Engineering**
Course Type:	**Core**
Year of Introduction:	**2023 – 24**

L	T	Practical component				C
		LPW	PW	W	S	
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Course Learning Outcomes (CLOs):

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

1. apply concepts of static electric and magnetic fields **(BL3)**
2. Select vector calculus and coordinate system transformation in electric and magnetic field applications **(BL4)**
3. make use of concepts of ordinary differential equations for solving and modelling electrical engineering problems **(BL3)**
4. evaluate solutions for engineering systems using numerical methods **(BL5)**

Syllabus: **Teaching Hours: 30**

Unit-1 Vector Calculus **08**

Vector Algebra, Cartesian-cylindrical-spherical coordinate systems, transformation of systems, differentiation of vectors, scalar and vector fields, gradient of a scalar function, directional derivative, divergence and curl of vector and their physical meaning, line - surface and volume integrals, Divergence theorem, Stokes's theorem.

Unit-2 Application of Vector Calculus in Electric Field Theory **07**

Coulomb's law, fields due to line charge, continuous volume charge and sheet charge, Gauss law and its application, Biot-Savart's law, Ampere's law and its applications, scalar and vector magnetic potentials, Force on a moving charge, differential current element, electric and magnetic dipole, Faraday's law of electromagnetic induction.

Unit-3 Ordinary Differential Equations **07**

Higher order ordinary differential equation: Linear differential equations with constant coefficient, Complementary functions and particular integral, Method of variation of parameters, Equations reducible to linear equations with constant coefficient (Cauchy's and Legendre's linear equations), Simultaneous linear equations with constant coefficient.

Unit-4 Numerical Methods **08**

Solution of Transcendental and Algebraic Equations, Newton-Raphson, Bisection, False position, Iteration methods, convergence of these methods; Solution of system of linear equations: Gauss-Seidel and Gauss-Jacobi's methods; Numerical solutions of ordinary differential equations: solution of initial value problems: Picard's method, Taylor series method, 4th order Runge-Kutta method, applications in Electrical Engineering.

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

Tutorial Work:
This shall consist of at least 06 tutorials based on the above syllabus.

Suggested Reading:

1. William H. Hayt and John A. Buck, Engineering Electromagnetics, TMH Publishing Company Ltd.
2. Nathan Ida, Engineering Electromagnetics, Springer (India) Pvt. Ltd., New Delhi.
3. Mathew N. O. Sadiku, Elements of Electromagnetics, Oxford University Press, New Delhi.
4. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Pvt. Ltd., New Delhi
5. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, UK
6. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers
7. S. C. Chapra and R. P. Canale, Numerical Methods for Engineers with Programming and Software Applications, McGraw-Hill Publications
8. M. K. Jain and S. R. K. Iyengar, R. K. Jain-Numerical Methods for Scientific & Engineering Computation, New age International Publication

L = Lecture, T = Tutorial, P = Practical, C = Credit

w.e.f. academic year 2023 - 24 and onwards