

Semester:	2			
Course Code:	EM1030			
Course Name:	Differential Equations			
Credit Value:	2 (Notional hours: 100)			
Prerequisites:	None			
Core/Optional	Core			
Hourly Breakdown	Lecture hrs.	Tutorial hrs.	Assignment hrs.	Independent Learning & Assessment hrs.
	24	6	-	70

Course Aim: To introduce analytical solving techniques for differential equations with constant coefficients and interpret the solutions.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

- **Solve** higher order ordinary differential equations with constant coefficients.
- **Analyze** the solution of a second order ordinary differential equation with constant coefficients.
- **Apply** matrix methods and Laplace transform in solving systems of ordinary differential equations with constant coefficients.
- **Select** analytical solutions of first order linear partial differential equations using method of characteristics.
- **Classify** second order linear partial differential equations and solve the wave equation, the Laplace equation and the heat equation.

Course Content:

- **Second Order Ordinary Differential Equations:** Spring mass damper equation: forced oscillations and resonance.
- **Laplace Transform:** Definition, existence and properties; Laplace transform of standard functions, derivatives and integrals; solve ordinary differential equations with constant coefficients; discontinuous forcing functions; convolution.
- **Boundary Value Problems:** boundary value problem of a second order differential equation with constant coefficients using direct calculation; Euler Bernoulli equation and Macaulay's Bracket method.
- **Systems of ODEs:** converting higher-order differential equations to a system of first-order differential equations; eigenvalue eigenvector method; matrix exponential method.

- **First order linear partial differential equations:** Partial differential equations as a mathematical model and Classification; Method of characteristics.
- **Second order linear partial differential equations:** classification: hyperbolic, parabolic and elliptic equations; Fourier series; method of separation of variables: wave equation, heat equation, Laplace equation on rectangular domains with homogeneous boundary conditions.

Teaching /Learning Methods:

Classroom lectures, tutorial discussions and in-class assignments

Assessment Strategy:

Continuous Assessment 50%	Final Assessment 50%		
Details: Tutorials/Assignments/Quizzes 20% Mid Semester Examination 30%	Theory (%) 50%	Practical (%) -	Other (%) -

Recommended Reading:

- R.K. Nagle, E.W. Saff, A.D. Snider, Fundamentals of Differential Equations, 8th edition, (2012), Pearson Education.
- E. Kreyszig, Advanced Engineering Mathematics, 9th edition, (2010), John Wiley & sons Inc.
- Jiří Lebl, Differential Equations for Engineers, Open Education Resource (OER) LibreTexts Project (<https://LibreTexts.org>).
- Walter A. Strauss, Partial Differential Equations, 2nd edition,(2007), John Wiley and Sons Inc.