Course Code	EM216
Course Title	Differential Equations
No. of Credits	3
Pre-requisites	
Compulsory/Optional	Compulsory for Mechanical Engineering Specialization

Aim(s): To introduce analytical solving techniques of linear ordinary differential equations and interpret the solutions

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

- Identify/derive the mathematical models of many physical problems as differential equations.
- Solve first order separable, linear and exact differential equations and reducible forms
- Solve higher order linear ordinary differential equations analytically and analyze the solution of such second order equations
- Apply matrix methods and Laplace transform in solving systems of linear systems of ordinary differential equations.
- Find and classify the critical points of a first order autonomous equation and use them to describe the qualitative behavior and the stability of the solutions.
- Obtain analytical solutions of first order and second order linear partial differential equations.

Time Allocation (Hours): Lectures 35 Tutorials 10 Practical Assignments **(Notional Hours 150)**

Course content/Course description:

- **Introduction:** Differential Equations as a mathematical model and Classification
- **First order ordinary Equations:** Separable, Linear, Exact, Reducible forms
- **Higher order ordinary linear equations with constant coefficients:** D-operators, Method of undetermined coefficients; Solution behaviors.
- **Linear Systems:** Eigenvalue and eigenvector method; Decoupling; Matrix exponential method
- **Laplace Transforms:** Laplace transform of functions and derivatives; Solving ordinary differential equations and linear systems; Convolution
- **Partial differential equations:** Partial differential equations as a mathematical model and Classification; Method of characteristics, Method of separation of variables and the d'Alermbert solution.

Recommended Texts :

- 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.
- Philip Franklin, Differential Equations for Engineers, 5th edition, (1980), Dover Publications.
- Walter A. Strauss, Partial Differential Equations, 2nd edition,(2007), John Wiley and Sons Inc.

Assessment	**Percentage Mark**
In-course Tutorials Mid Semester Examination	 10 30
End-semester	60