

## Details of Course

Course Title	Course Structure			Pre-Requisite
MC 210: Differential Equations	L	T	P	Basic knowledge of calculus and matrix
	3	0	2	

Course Objective: To impart the knowledge of ordinary and partial differential equations and to analyze and solve the physical problems.

### Course Outcome (CO):

CO1	Evaluate linear systems of differential equations, both homogeneous and non-homogeneous by matrix method and Sturm-Liouville boundary value problems including orthogonality properties.
CO2	Analyse the stability of linear and non-linear differential equations through phase portrait diagram.
CO3	Formulate partial differential equations, evaluate linear, quasi linear and non-linear first order PDEs and address Cauchy's problem for first order PDE.
CO4	Solve homogeneous and non-homogeneous linear PDE with constant coefficients and classify second order PDE to determine characteristics.
CO5	Apply the method of separation of variables to solve initial and boundary value problem including heat equation, wave equation and Laplace equation.

S. No.	Contents	Contact hours
1.	Ordinary differential Equations I (ODEs): Solutions of linear system of differential equations (homogenous and non-homogenous) by matrix method, Sturm-Liouville boundary values problems including characteristic functions and orthogonality.	8
2.	Ordinary differential equations II: Linear and Non-linear autonomous systems, Phase plane, Paths, Critical Points and its types, Stability of the critical points, Phase plane analysis, Liapunov's direct method, periodic solutions, limit cycle.	8
3.	Partial differential equations I (PDEs): Formation of PDEs, Linear and Quasi-linear first order PDEs (Lagrange form), Cauchy's problem for first order PDEs, Non-linear first order PDEs: Standard forms and Charpit's method.	8
4.	Partial differential equations II: Linear Homogeneous and Non-homogeneous second and higher order PDEs with constant coefficients, Classification of second order PDEs, Characteristic equations and characteristic curves, method of separation of variables.	9
5.	Applications of partial differential equations: One-dimensional heat equation, one-dimensional wave equation, two-dimensional heat equation (solution of Laplace equation in Cartesian and polar coordinates).	9
	Total	42

**Suggested Books:**

S. No.	Name of Books/Authors/Publishers	Year of Publication
1.	Martin Braun, Differential equations and their applications, Springer, 4 <sup>th</sup> Edition	1993
2.	S. L. Ross, Introduction to Ordinary Differential Equations, John Wiley & Sons, 4 <sup>th</sup> Ed.	1989
3.	R.K Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa, 5 <sup>th</sup> Ed.	2017
4.	K S Rao, Introduction to Partial Differential Equations, Prentice Hall India, 3 <sup>rd</sup> Edition	2011
5.	E. Kreyszig, Advanced Engineering Mathematics, Wiley Publications, 10 <sup>th</sup> Edition	2017
6.	Peter V.O. Neil: Partial Differential equations: Peter V. O'Neil, Wiley Publication, 3 <sup>rd</sup> Ed.	2014