Course Title	**Differential Equations**
Course Code	**MPHY-204**
Credit Hours	**CH3**
Pre- requisites	**MPHY-101, MPHY-102**
Learning outcomes	The objectives of this course are to understand different techniques solve the differential equations.
Contents	**First order differential equation**: Definitions and terminology, Initial-value problems, Linear and nonlinear equations, general solution, Particular solution, explicit solution, implicit solution, First order differential equation, Separable variables, linear differential equations, exact equations, Solution by substitution, **Higher order equations:** Higher-order differential equations, linear equations (Initial-value and Boundary value problems, homogeneous equations, non-homogeneous equations), Reduction of order, Homogeneous linear equations with constant coefficients, Undetermined coefficients (Superposition approach, Annihilator approach), Variation of parameters, Cauchy-Euler equations, Solving systems of linear equations by elimination, Spring/Mass systems (Free undamped motion, Free damped motion and driven motion), Resonance and Beats Series Circuit (RC series circuit, LC series circuit, RL series circuit and RLC series circuit), nonlinear equations Bernoulli's equation, first order non-linear ordinary differential equation, Clairaut's equation, Riccati equation, higher order exact linear equations, **Series solution of linear equations: S**eries solutions about ordinary points, power series solution, solution about singular points, method of Frobenius series solutions, Legendre's equation, Bessel's equations
Teaching-learning Strategies	Classroom teaching / Lecturing
Assignments- Types and Number	Problem sheet: 3-4
Text Books	1. Mathematical Methods for Physicists (7^{th} Edition) by G. B. Arfken, H. J. Weber and F. E. Harris, Academic Press (2012). 2. A First Course in Differential Equations with Modeling Applications (10^{th} Edition) by D. G. Zill, Jones and Bartlett (2013). 3. Elementary Differential Equations and Boundary Value Problems by W. E. Boyce, R. C. DiPrima and D. B. Meade, Wiley (1992). 4. Mathematical methods for physics and engineering, Cambrige University Press (1999) 5. Elementary Differential Equations with Boundary Value Problems by C. H. Edwards and D. E. Penney, Prentice Hall (1989).