Course No.	Course Name	L-T-P-Credits	Year of Introduction
MA102	**DIFFERENTIAL EQUATIONS**	**3-1-0-4**	**2016**

Course Objectives

This course introduces basic ideas of differential equations, both ordinary and partial, which are widely used in the modelling and analysis of a wide range of physical phenomena and has got applications across all branches of engineering. The course also introduces Fourier series which is used by engineers to represent and analyse periodic functions in terms of their frequency components.

Syllabus

Homogeneous linear ordinary differential equation, non-homogeneous linear ordinary differential equations, Fourier series, partial differential equation, one dimensional wave equation, one dimensional heat equation.

Expected Outcome

At the end of the course students will have acquired basic knowledge of differential equations and methods of solving them and their use in analysing typical mechanical or electrical systems. The included set of assignments will familiarise the students with the use of software packages for analysing systems modelled by differential equations.

TEXT BOOKS

- Erwin Kreyszig: Advanced Engineering Mathematics, 10th ed. Wiley
- A C Srivastava, P K Srivasthava, Engineering Mathematics Vol 2. PHI Learning Private Limited, New Delhi.

REFERENCES:

- Simmons: Differential Equation with Applications and its historical Notes,2e McGrawHill Education India 2002
- Datta, Mathematical Methods for Science and Engineering. CengageLearing,1st. ed
- B. S. Grewal. Higher Engineering Mathematics, Khanna Publishers, New Delhi.
- N. P. Bali, Manish Goyal. Engineering Mathematics, Lakshmy Publications
- D. W. Jordan, P Smith. Mathematical Techniques, Oxford University Press, 4th Edition.
- C. Henry Edwards, David. E. Penney. Differential Equations and Boundary Value Problems. Computing and Modelling, 3rd ed. Pearson

COURSE PLAN			
	COURSE NO: MA102	L-T-P:3-1-0	
	COURSE NAME: DIFFERENTIAL EQUATIONS	CREDITS:4	
MODULE	**CONTENT**	**HRS**	**END SEM. EXAM MARKS (OUT OF 100)**
I	HOMOGENEOUS DIFFERENTIAL EQUATIONS (Text Book 1 : Sections 1.7, 2.1, 2.2, 2.6, 3.2) Existence and uniqueness of solutions for initial value problems, Homogenous linear ODEs of second order. Homogenous linear ODEs with constant coefficients, Existence and Uniqueness of solutions Wronskian, Homogenous linear ODEs with constant Coefficients (Higher Order) (For practice and submission as assignment only: Modelling of free oscillations of a mass – spring system)	3 4	17
II	NON-HOMOGENEOUS LINEAR ORDINARY DIFFERENTIAL EQUATIONS (Text Book 2: Sections 1.2.7 to 1.2.14) The particular Integral (P.I.), Working rule for P.I. when g(x) is X^m , To find P.I. when g(x) = $e^{ax}.V_1(x)$, Working rule for P.I. when g(x) = x.V(x), Homogeneous Linear Equations, PI of Homogenous equations Legendde's Linead eduations Method of variation of parameters for finding PIs (For practice and submission as assignments only: Modelling forced oscillations, resonance, electric circuits)	7 2 3	17
FIRST INTERNAL EXAM			
III	FOURIER SERIES (Text Book 2 - Sections 4.1,4.2,4.3,4.4) Periodic functions ,Orthogonally of Sine and Cosine functions (Statement only), Fourier series and Euler's formulas Fourier cosine series and Fourier sine series (Fourier series of even and Odd functions) Half range expansions (All results without proof)	3 3 3	17

	(For practice and submission as assignment only: Plots of partial sums of Fourier series and demonstrations of convergence using plotting software)		
IV	PARTIAL DIFFERENTIAL EQUATIONS (Text Book 2 : Sections : 5.1, 5.1.1, 5.1.2, 5.1.5, 5.2.6- 5.2.10) Introduction to partial differential equations , formation of PDE, Solutions of first order PDE(Linear only) Lagrange's Method Linear PDE with constant coefficients , Solutions of Linear Homogenous PDE with constant coefficients , Shorter method for finding PI when g(x,y)=f(ax+by), Method of finding PI when $g(x,y) = x^m y^n$, method of find PI when $g(x,y)= e^{ax+by} V(x,y)$	**3** **3** **6**	**17**
SECOND INTERNAL EXAM			
V	ONE DIMENSIONAL WAVE EQUATION (Text Book 2: Sections :6.1-- 6.4) Method of separation of variables The wave Equation Vibrations of a stretched string Solutions of one dimensional wave equation using method of separation of variables and problems	**2** **1** **1** **4**	**16**
VI	ONE DIMENSIONAL HEAT EQUATION (Text Book 2: sections 6.7, 6.8 ,6.9, 6.9.1 ,6.9.2) The equation of Heat conduction One dimensional Heat transfer equation. Solutions of One Dimensional Heat transfer equation, A long insulated rod with ends at zero temperatures, A long insulated rod with ends at non zero temperatures	**1** **1** **6**	**16**
END SEMESTER EXAM			

TUTORIALS: Tutorials can be ideally conducted by dividing each class into three groups. Prepare necessary materials from each module that can be practiced using computer software. Use them uniformly in every class.