Marwadi University

Bachelor of Technology

Civil/ Mechanical/ Automobile Engineering

Applied Differential Equation

01MA1301

Objective of the Course:

The subject aims to make the learner able to apply the knowledge of differential equations and numerical methods to solve core Engineering and real-world problems.

Credit Earned: 05

Students learning outcomes:

After successful completion of the course, it is expected that students will be able to,

1. Apply Laplace transform and Fourier series to solve differential equations.
2. Classify and apply the standard methods to solve ordinary differential equations.
3. Expand various functions in terms of sine and cosine functions.
4. Apply partial differential equations in engineering problems.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA (M)	CSE (I)	Viva (V)	Term Work (TW)	
03	02	00	05	50	30	20	25	25	150

Detailed Syllabus

Sr No.	Title of the unit	Number of hours
1	**Fourier Series, Fourier integral and Some Special Functions**	**10**
	Periodic function, Trigonometric series, Fourier series for functions of any period, Even and odd functions, Half-range Expansion, Fourier integrals. Definitions of: Gamma function, Beta function, Error function and complementary Error function, Heaviside's function, pulse unit height and duration function, Sinusoidal Pulse function, Rectangle function, Gate function, Dirac's Delta function, Signum function, Saw tooth wave function, Triangular wave function, Halfwave rectified sinusoidal function, Full rectified sine wave, Square wave function.	
2	**Laplace Transforms**	**10**
	Laplace transforms definition, Laplace transforms of some elementary functions, Inverse transforms, Linearity and shifting properties, Laplace	

	transforms of derivatives and integrals, Differentiation and integrations of Transforms, Convolution theorem and its application to obtain inverse Laplace transform, Laplace transform of periodic functions, Unit step function, Unit impulse function (Dirac delta function), second shifting property, Applications of Laplace transforms to solve ODE and system of ODE	
4	**Higher-Order ODE with Applications**	**12**
	Solution of homogeneous linear differential equations with constant coefficients, Nonhomogeneous linear differential equations, Variation of Parameters, Euler-Cauchy's differential equations with variable coefficients, Application of ODE**:** Mechanical vibration system, Newtons Colling law.	
5	**Partial Differential Equations**	**10**
	Formation of PDE, Classification of 2nd order PDE, Solution of Partial Differential Equations, Lagrange's linear partial differential equation, Special types of Nonlinear PDE of the first order, method of separation of variables, Homogeneous and Non-homogeneous PDE, Application of PDE: Heat, wave, Laplace equations and their solution by the method of separation of variables and Fourier series.	
6	**Application of ODE and Laplace by MATLAB**	**To be covered in Tutorial hours**
	Laplace transforms of some function, Inverse Laplace transform of some function, Solution of the Differential equation, Solution of Differential equation with IVP and BVP	
	Total	**42**

List of Tutorials:

1.Theory and Example on Fourier series.
2.Theory and Example on Laplace Transforms.
3.Theory and Example on Higher Order ODE.
4.Theory and Example on partial differential equation.

Suggested Theory Distribution

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve an effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
15%	15%	40%	15%	10%	05%

Instructional Method and Pedagogy:

1. At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
2. Lectures will be taken in class room with the use of multi-media presentations, black board – mix of both.
3. Attendance is compulsory in lectures and laboratory which carries a 5% component of the overall evaluation.
4. Minimum two internal exams will be conducted and average of two will be considered as a part of 15% overall evaluation
5. Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weightage of 5%.

Recommended Study Material:

Recommended Textbooks:

Erwin Kreyszig: Advanced Engineering Mathematics, 8th Ed., Jhon Wiley & Sons, India,1999.

Reference Books:

1. Engineering mathematics 2, by Baburam Pearson.

2. W.E.Boyce and R.Diprima ,Elementry Differential Equation(8^{th} Edition),John wiley(2005)

3. Wylie & Barrett: Advanced Engineering Mathematics, Mc graw Hill pub.

4. Greenberg M D: Advanced Engineering Mathematics, 2nd ed., Pearson.

List of Open Base Software/learning website:

Web site:

1. http://mathworld.wolfram.com/
2. http://en.wikipedia.org/wiki/Mat