B.E.Semester : III Civil Engineering

Subject Name: Differential Equations and Integral Transforms (CC301-A)

A. Learning objectives:

The objective of this course is

- To present the foundations of many basic Mathematical tools and concepts related Engineering.
- To provide a coherent development to the students for the courses of various branches of Engineering like Control Theory , Circuits and Networks, Digital Logic design ,Fluid Mechanics, Machine Design etc
- To enhance the student's ability to think logically and mathematically.
- To give an experience in the implementation of Mathematical concepts which are applied in various field of Engineering.

B. Teaching Scheme (Credits and Hours)

Teaching scheme				Total Credit	Evaluation Scheme					
L	T	P	Total		Theory		Mid Sem Exam	CIA	Pract.	Total
Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	Marks
03	02	00	05	05	03	70	30	20	00	120

C.Detailed Syllabus

Unit No	Details
	Differential Equations
1	**First Order Ordinary Differential Equations:** basic concepts- formation and solution,Geometric meaning of y' = f(x,y), Direction fields, Exact differential equations, Reduction of Non exact differential equation using , Integrating factor, Linear differential equations, Bernoulli equations, Homogeneous equation –reduction to separable form,**Applications** – Geometrical; tangent, normal of curves, orthogonal trajectories of curves. Growth and Decay.
2	**Higher Order Ordinary Differential Equations:** Basic- General solution and particular integral, Auxiliary equation, complementary function. Linear differential equations of second and higher order: Homogeneous linear differential equations of second order, Euler-Cauchy Equations, Wronskian, Non homogeneous equations, Solution by undetermined coefficients, Solution by variation of parameters .System simultaneous linear differential equations. Higher order linear differential equations, Higher order homogeneous with constant coefficient, Higher order non homogeneous equations. Solution by [1/f(D)] r(x) method for finding particular integral.**Applications**- Mass spring Mechanical System -Free, damped, undammed & forced Oscillations. RLC circuits. Simple Pendulum.
3	**Partial Differential Equations and Applications:** Basic Concepts-Formation PDEs, Order , Linearity & Homogeneity of PDE, Solution of Partial Differential equations f(x,y,z,p,q) = 0, Nonlinear PDEs first order, Some standard forms of nonlinear PDE, Linear PDEs with constant coefficients, Equations reducible to Homogeneous linear form, Non Homogeneous Linear PDE, Classification of second order linearPDEs. Method Separation of variables.**Applications**- One Dimensional Wave equation, One Dimensional Heat equation, Two DimensionalLaplace equation.
	Integral Transform
4	**Laplace transforms:** - Definition of the Laplace transform, Inverse Laplace transform, Linearity, Shifting theorem. Laplace transforms of derivatives and integrals.Unit step function, Dirac's delta function, Properties of inverse Laplace transform. Convolution Theorem. Complex inversion formula. Application of Laplace Transformation.
5	**Fourier Series:** Periodic function, Trigonometric series, Fourier series, Functions of any period, Even and odd functions, Half-range Expansion.

6 **Fourier transform:**Definition and properties of Fourier sine, cosine and complex transforms: Convolution theorem. Inversion theorems. Fourier transform of derivatives.

7 **Z Transforms:** Definition and properties of Z- Transforms, Inverse Z- Transforms, and Application of Z- Transforms to difference equations.

D.Lesson Planning:

Unit No	Topics	Hours	Weightage
1	**First Order Ordinary Differential Equations**	8	15%
2	**Higher Order Ordinary Differential Equations**	10	25%
3	**Partial Differential Equations and Applications**	10	24%
4	**Laplace transforms**	6	12%
5	**Fourier Series**	2	6%
6	**Fourier transform**	5	10%
7	**Z Transforms**	4	8%

List of Tutorials

Sr. No.	Tutorial Content
1	Problem solving on "**First Order Ordinary Differential Equations".**
2	Problem solving on "**Higher Order Ordinary Differential Equations"**
3	Assignment on "**Partial Differential Equations and Applications".**
4	Assignment on "**Laplace transforms".**
5	Problem solving on "**Fourier Series"**
6	Assignment on **"Fourier transform".**
7	Assignment on **"Z Transforms".**

E. Instructional Method and Pedagogy (Continuous Internal Assessment (CIA) Scheme)

- Two Faculties will be covering the syllabus in each branch for 5 hours in a week. In Tutorial, class must be divided into two subclasses & faculties will be solving or assigning the problem of the subject in each subclass.
- Attendance is compulsory in lectures and Tutorial which carries 05 Marks.
- At regular intervals assignments is given to all students which carries 30 marks. Evaluation of these assignments will be observed under Daily Homework Daily Assessment (DHDA) System.
- Classroom participation and involvement in solving the problems in Tutorial rooms carries 05 Marks.
- Viva Voce will be conducted at the end of the semester of 10 Marks.
- One internal exam of 30 marks is conducted as a part of internal theory evaluation.

F. Students Learning Outcomes:

At the end of the course

- The students will be able to think logically and mathematically in any field of engineering.
- The students will gain an experience in the implementation of Mathematical concepts which are applied in various field of Engineering.

G. Text Books & Reference Books:

1. "Advanced Engineering Mathematics (8th Edition)", by E. Kreyszig, Wiley-India (2007).
2."Differential Equations",E.Rukumangadachari, Pearson.
3. "HigerAngineering Mathematics" B V Ramana,Tata McGraw-Hill.
4. "Elementary Differential Equations (8th Edition)",W. E. Boyce and R. DiPrima, John Wiley
5. "Engineering Mathematics Vol 2", by Baburam, Pearson
6. M.D Raisinghania, Ordinary and Partial Differential Equations, S Chand & Co.
7. Gerald B Folland, Introduction to Partial Differential Equations, 2nd edition, Prentice – Hall of India (2001.)
8. C. E. Froberg, Introduction to Numerical Analysis (2nd Edition), Addison-Wesley,