Source: https://www.google.co.in

19HS111 ENGINEERING MATHEMATICS II (E)

DIFFERENTIAL EQUATIONS & FOURIER SERIES

Hours Per Week :

L	T	P	C
3	0	2	4

Total Hours :

L	T	P
45	0	30

WA/RA	SSH/HSH	CS	SA	S	BS
20	45	-	10	-	5

COURSE DESCRIPTION AND OBJECTIVES:

To provide students with solid foundation in mathematical fundamentals such as numerical methods, ordinary and partial differential equations, Fourier series, Laplace transformations required for different branches of Engineering.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes	POs
1	Understand discuss the Laplace transformation of a function and apply to solve differential equations.	1, 2
2	Apply various numerical methods to solve differential equations.	1, 2
3	Compute the solutions of differential equations by using analytical techniques.	1, 2
4	Illustrate the concept of Fourier series.	1, 2
5	Use software tools to obtain and verify the solutions.	5

SKILLS:

- ✓ *Find the complete solution of second and higher order ordinary differential equations with constant coefficients.*
- ✓ *Compute numerical solutions of differential equation by appropriate methods.*
- ✓ *Solve partial differential equation by suitable method.*
- ✓ *Obtain the Fourier series of periodic function.*
- ✓ *Apply Laplace transformations to solve ordinary differential equations.*

UNIT – I **L-9**

HIGHER ORDER ORDINARY DIFFERENTIAL EQUATIONS : Linear differential equations with constant coefficients, Homogeneous differential equations of second and higher order, Methods to find particular integral when RHS is of the form : e^{ax} ,sin ax, cos ax and x^n.

UNIT – II **L-9**

NUMERICAL METHODS TO SOLVE DIFFERENTIAL EQUATIONS & APPLICATIONS OF FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS:

Numerical Methods : Taylor series method, Picard's method, Euler's and modified Euler's method, Runge-Kutta method.

Applications : Newton's law of cooling, Law of natural growth and decay, Orthogonal trajectories.

UNIT – III **L-9**

FIRST ORDER PARTIAL DIFFERENTIAL EQUATIONS : Introduction, Partial differential equations, Order and degree, Formation of partial differential equations; Lagrange's linear equations, Method of multipliers, Non-linear equations in p and q, Charpit's method.

UNIT – IV **L-9**

FOURIER SERIES : Periodic Functions, Fourier series, Dirichlet's conditions, Fourier series for discontinuous functions, Fourier series for function defined in two or more sub-ranges, Fourier series for even and odd functions, Half-range series, Change of interval and functions having arbitrary period.

UNIT – V **L-9**

LAPLACE TRANSFORMATIONS : Introduction, Laplace transformation, Properties, Change of scale property, Shifting theorems, Laplace transformation of derivative, Laplace transformation of integral, Multiplication by t, Initial and final value theorems, Convolution theorem.

Inverse Laplace transformation, Multiplication by s, Division by s, Shifting properties, Inverse Laplace transformation of derivatives.

Applications : Solutions of ordinary differential equations.

ACTIVITIES:

- *Compute exact solutions to second order differential equations by various methods.*
- *Apply iterative methods to solve differential equations and compare with results obtained using any software like MATLAB.*
- *Differentiate methods to solve partial differential equations*

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS **TOTAL HOURS:30**

1. Limits and Continuity of functions of one variable.
2. Differentiation of functions of one variable and two variables.
3. Integration of functions of one variable and two variables.
4. Ordinary differential Equations.
5. Euler's method for first order ODE.
6. Runge-Kutta method for first order ODE.
7. Gradient of Scalar functions.
8. Directional Derivative of a Scalar functions.
9. Divergence of Vector function.
10. Curl of Vector function.
11. Fitting of Curve for given data.
12. Plotting of graph for functions of one variable.

TEXT BOOKS:

1. H. K. Dass and Er. Rajanish Verma, "Higher Engineering Mathematics", S. Chand & Co., 3rd edition, 2015.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44th edition, 2018.

REFERENCE BOOKS:

1. John Bird, "Higher Engineering Mathematics", Routledge (Taylor & Francis Group), 2018.
2. Srimanta Pal and Subodh C. Bhunia, "Engineering Mathematics", Oxford Publications, 2015.
3. B. V. Ramana, "Advanced Engineering Mathematics", TMH Publishers, 2008.
4. N. P. Bali and K. L. Sai Prasad, "A Textbook of Engineering Mathematics I, II, III", Universal Science Press, 2018.
5. T. K.V. Iyengar et al., "Engineering Mathematics, I, II, III", S. Chand & Co., 2018.