16HS103 ENGINEERING MATHEMATICS - I

Hours Per Week :

L	T	P	C
3	1	2	5

Total Hours :

L	T	P
45	15	30

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

Course Description and Objectives:

It is aimed to offer various analytical as well as numerical methods to solve first and second order ordinary differential equations; to impart the knowledge of partial differentiation; to acquaint with the various methods to solve first and second order partial differential equations; to make the student familiar with applications of first order ordinary differential equations. To make the student to use different mathematical tools of MATLAB related to above concepts.

Course Outcomes:

The student will be able to:

- recognise and solve different types of first order ordinary differential equations.
- find the complementary functions and particular integral of second and higher order ordinary differential equations with constant coefficients.
- apply the knowledge of ordinary differential equations in some instances.
- solve ordinary differential equations, with initial conditions, numerically.
- find the local maxima/minima of given function of two variables.
- eliminate arbitrary constants/functions from given relations to form partial differential equations.
- solve linear and non-linear partial differential equations of standard types.
- classify second order partial differential equations and solve them.

SKILLS:

- ✓ *Solve given differential equation by suitable method.*
- ✓ *Compute numerical solutions of differential equation by apt method.*
- ✓ *Compute maxima/minima of given function.*
- ✓ *Solve given partial differential equation by appropriate method.*

ACTIVITIES:

- *Differentiate methods to solve given differential equation.*
- *Compute numerical solutions to differential equation and compare the result with MATLAB output.*
- *Compute maxima/minima of given function.*
- *Differentiate methods to solve given partial differential equation.*
- *Estimation of acoustic impedance of a given material.*

UNIT - 1 **L- 9, T-3**

FIRST ORDER DIFFERENTIAL EQUATIONS: Variable separable, Homogeneous differential equations, Linear differential equations, Bernoulli's differential equations, Exact and non-exact differential equations.

UNIT - 2 **L- 9, T-3**

SECOND ORDER 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}, sinax, cosax and x^n.

UNIT - 3 **L- 9, T-3**

APPLICATIONS OF FIRST ORDER DIFFERENTIAL EQUATIONS: Orthogonal trajectories (including polar form), Newton's law of cooling, Law of natural growth and decay.

NUMERICAL METHODS TO SOLVE DIFFERENTIAL EQUATIONS: Taylor series method, Picard's method, Euler's and modified Euler's method, Runge-Kutta method.

UNIT - 4 **L- 9, T-3**

MAXIMA/MINIMA OF FUNCTIONS OF TWO VARIABLES: Review of partial differentiation - Partial derivatives, Partial derivatives of higher order; Homogeneous function, Euler's theorem, Total differential coefficient, Maxima and Minima of a function of two variables, Conditions for extreme values, Lagrange method of undetermined multipliers.

JACOBIANS : Definition, Properties, Jacobian of implicit functions.

UNIT - 5 **L- 9, T-3**

PARTIAL DIFFERENTIAL EQUATIONS: Formation of partial differential equations, Linear (Lagrange) equations, Method of multipliers, Non-linear partial differential equations (Types), Charpit's method, Second order linear equations with constant coefficients only, Classifications, Rules to find complimentary function and particular integral (special cases).

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS Total hours-30

1. Basic mathematical operations using MATLAB.
2. Solving simple expressions.
3. Limits.
4. Continuity.
5. Symbolic differentiation.
6. Symbolic integration.
7. Plotting of curves.
8. Plotting of surfaces.
9. Maxima & minima of functions of one variable.
10. Maxima & minima of functions of two variable.
11. Solving first order O.D.E.
12. Euler's Method and R-K Method.

TEXT BOOKS:

1. H. K. Dass and Er. Rajanish Verma, "Higher Engineering Mathematics", 3rd edition, S. Chand & Co, 2014.
2. B. S. Grewal, "Higher Engineering Mathematics", 44th edition, Khanna Publishers, 2014.
3. Rudra Pratap, "Getting started with MATLAB", Oxford University Publication, 2009.

REFERENCE BOOKS:

1. Srimanta Pal and Subodh C. Bhunia, "Engineering Mathematics", Oxford Publications, 2015.
2. B. V. Ramana, "Advanced Engineering Mathematics", McGraw Hill education, 25th reprint, 2015.