

# 16HS103 ENGINEERING MATHEMATICS - I

Hours Per Week :

L	T	P	C
3	1	2	5

Total Hours :

L	T	P	WA/RA	SSH/HSH	CS	SA	S	BS
45	15	30	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:**

- O Differentiate methods to solve given differential equation.
- O Compute numerical solutions to differential equation and compare the result with MATLAB output.
- O Compute maxima/minima of given function.
- O Differentiate methods to solve given partial differential equation.
- O 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  $e^{ax}$ ,  $\sin ax$ ,  $\cos ax$  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).

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## 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", 3<sup>rd</sup> edition, S. Chand & Co, 2014.
2. B. S. Grewal, "Higher Engineering Mathematics", 44<sup>th</sup> 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, 25<sup>th</sup> reprint, 2015.