Applied Mathematics-I

1.1 Course Number: MA 123

1.2 Contact Hours: 40 (L) Credits: 11 [LTP: 3-1-0]

1.3 Semester-offered: Odd (I^{st})

1.4 Prerequisite: None

1.5 Syllabus Committee Member:

2. **Objective:** The key objectives of the course are:
   - ☞ To set forth the process of thinking by which the concepts and methods of real analysis and calculus are developed.
   - ☞ This novel course is designed to cater to the needs of foundation in modern technology.
   - ☞ This course stands on the boarder-line between Elementary Mathematics (algebra, plain geometry, etc.) and the more advance abstract analysis.
   - ☞ Several fundamental phenomena occurring in the nature are expressed as a differential equation. Students must know how to model any physical phenomena using differential equations.

3. **Course Content:** Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	**Real Analysis**	Sequence, series and convergence tests. Limit, continuity, differentiability/successive differentiation. Rolle's theorem, Lagrange and Cauchy's mean value theorems, Taylor's theorem. Indeterminate forms and L'Hospital's rule. Riemann integration, Differentiation under integral sign: Leibnitz rule. Improper integrals and their convergence. Beta-Gamma functions and properties.	15
2	**Multi-Variable Calculus**	Functions of several variables, Limit, continuity and differentiability. Partial derivatives and total derivatives. Jacobian. Maxima/Minima. Evaluation of double integrals, change of order of integration and application, Evaluation of triple integrals, change of coordinates and substitution, evaluation of volumes of solids and curved surfaces, mass, center of gravity of two and three dimensional structures.	11
3	**Vector Calculus**	Directional derivative, normal line. Differentiation and integration of vector valued functions: line, surface and volume integrals, application to work done/circulation, outward flux; gradient, divergence, curl. Green's, Gauss' and Stoke's theorems (without proof).	5

4	**Ordinary Differential Equations**	Introduction to a differential equation, order and degree of differential equations. Concept of solution: general solution, singular solution, implicit solution explicit solution. Separable form, reduction to separable form, exact differential equations, integrating factors. Bernoulli equations. Second-order equations: fundamental system and general solutions of homogeneous equations, Wronskian. Second-order Homogeneous equations with constant coefficients, auxiliary equations: real distinct roots, complex roots, repeated roots, reduction of order, variation of parameters. Euler-Cauchy equation	9
		Total	**40**

4. Readings

4.1 Textbook:

- *Thomas' Calculus* by Thomas, Hass, Heil and Weir. Pearson Education.
- *Real Analysis* by Bartle and Sherbert. Wiley.
- *Differential Equations with Applications and Historical Notes* by G.F. Simmons.

4.2 Reference books:

- ✓ *Basic Multivariable Calculus* by Marsden, Tromba & Weistein. Springer, India, Pvt. Ltd.
- ✓ *Vector Calculus* by S.J. Colley. Pearson Education.
- ✓ *Theory and Problems of Advanced Calculus* by M.R. Spiegel (Schaum Series)
- ✓ *Advanced Engineering Mathematics* by E. Kreyszig, Wiley-India Ed.
- ✓ *Advanced Engineering Mathematics* by H.K. Dass.
- ✓ *Higher Engineering Mathematics* by B.S. Grewal.
- ✓ *Differential Equations* by S.L. Ross.
- ✓ *Advanced Engineering Mathematics* by E. Kreyszig.

5 Outcome of the Course:

Every student in Engineering & Technology will be able to understand the contents of topics being covered in his branch. The students will also enlarge their mathematical concepts and operations and become familiar with the new mode of approach to a problem. This course will provide the fundamental concept of differential equations for obtaining the solutions of science and engineering problems.