Course title: Applied Mathematics – I

Course code: ECA XXX	**No. of credits:** 4	**L-T-P:** 46 -14 -0	**Learning hours:** 60

Pre-requisite course code and title (if any): N/A

Department: Sustainable Engineering

Course coordinator: Prof Naqui Anwer	**Course Instructor:**

Contact: naqui.anwer@terisas.ac.in

Course type: Core	**Course offered in:** Semester 1

Course description

The goal of this course is to achieve conceptual understanding and to retain the best traditions of basic calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling computational problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in understanding concepts of science, engineering, economics and computer science, among other disciplines.

Course objective

- To understand the fundamentals of calculus for energy and computer applications.
- To solve numerical problems on single and multivariable calculus.
- To learn calculating liner approximation, error estimates, maxima, minima and saddle points.
- To solve computational problems on single, double and triple integrals.

Course contents

Module	Topic	L	T	P
1	**Basic Calculus** Curvature, evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate length of curves, surface areas and volumes of solids of revolutions.	10	2	0
2	**Single variable Calculus (Differentiation)** Rolle's theorem, Mean value theorems and applications; Extreme values of functions; Linear approximation; Indeterminate forms and L' Hospital's rule.	8	2	0
3	**Sequences and series** Limits of sequence of numbers, Calculation of limits, Infinite series; Tests for convergence; Power series, Taylor and Maclaurin series; Taylor theorem, convergence of Taylor series, error estimates.	8	2	0
4	**Multivariable Calculus (Differentiation)** Limit, continuity and partial derivatives, directional derivatives, gradient, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers.	10	4	0
5	**Multivariable Calculus (Integration)** Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface Gauss and Stokes.	10	4	0
	Total	46	14	0

Evaluation criteria

Minor test 1: 20% (at the end of module 1&2)
Minor test 2: 20% (at the end of module 3&4) Assignment: 10% (at the end of module 1, 2 &3) Major test: 50% (at the end of the semester)

Learning outcomes

After completing the course, the students will be able to:

- To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
- The fallouts of Rolle's Theorem that is fundamental to the application of analysis to computational problems.
- The tool of power series and Fourier series for learning advanced energy & computational Mathematics.
- To deal with functions of several variables that are essential in most systems.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

Pedagogical approach

A combination of class-room interactions, expert lecture, assignment, tutorial, practical and case study

Textbooks / References:

1. Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing, 2023.
2. Reena Garg, Engineering Mathematics, Khanna Book Publishing, 2023.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
5. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
7. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
8. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Additional information (if any): NA

Student responsibilities

Adopt peer learning and knowledge sharing within the class, attendance, feedback, discipline: as per university rules

Course prepared by:

Prof. Naqui Anwer

Course Reviewer(s):

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