CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY
FACULTY OF APPLIED SCIENCES
MA 143: ENGINEERING MATHEMATICS –I
B. TECH. 1st SEMESTER (All Branches)

Credits and Hours:

Teaching Scheme	Theory	Tutorial	Total	Credit
Hours/week	4	1	5	4
Marks	100	-	100	

Prerequisites: Set theory, Function, Limit, Continuity, Differentiability for function of single variable and its uses, Sequence and Series

A. Outline of the course:

Sr No.	Title of the unit	Number of hours
1.	Higher order derivatives and applications	16
2.	Infinite Series and Complex numbers	14
3	Matrix Algebra- I	10
4.	Partial differentiations	08
5.	Applications of Partial differentiations	12
	Total hours	60

B. Detailed Syllabus:

1 Higher order derivatives and applications: 16 Hours 27%

1.1 Lagrange's Mean Value Theorem, Local Maxima and Minima of function of one variable

1.2 Successive differentiation: n^{th} derivative of elementary functions: rational, logarithmic, trigonometric, exponential and hyperbolic

1.3 Leibnitz rule for the n^{th} order derivatives of product of two functions

1.4 Power series expansion of a function: Maclaurin's and Taylor's series expansion.

1.5 L'Hospital's rule and related applications, Indeterminate forms

2 Infinite Series and Complex numbers 14 Hours 23%

2.1	Tests of convergence of series viz., comparison test, ratio test, root test, Leibnitz test		
2.2	Complex numbers and their geometric representation		
2.3	Complex numbers in polar and exponential forms		
2.4	De Moivre's theorem and its applications		
2.5	Exponential, Logarithmic, Trigonometric and hyperbolic functions		
3.	**Matrix Algebra- I:**	**10 Hours**	**17 %**
3.1	Definition of Matrix, types of matrices and their properties		
3.2	Determinant and their properties		
3.3	Rank and nullity of a matrix		
3.4	Determination of rank		
3.5	Solution of a system of linear equations by Gauss elimination and Gauss Jordan Methods		
4.	**Partial differentiations:**	**08 Hours**	**13%**
4.1	Partial derivative and geometrical interpretation		
4.2	Euler’s theorem with corollaries and their applications		
4.3	Chain rule		
4.4	Implicit functions		
4.5	Total differentials		
5.	**Applications of Partial differentiations:**	**12 Hours**	**20%**
5.1	Maclaurin’s and Taylor’s series expansion in two variables		
5.2	Tangent plane and normal line to a surface		
5.3	Maxima and Minima of function of two variables		
5.4	Lagrange’s method of undetermined multiplier		
5.5	Jacobian		
5.6	Errors and approximations		

Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.

- Attendance is compulsory in lectures/tutorials which carries a 5% component of the overall evaluation.
- Minimum two internal exams will be conducted and average of two will be considered as a part of 15% overall evaluation.
- Quiz (surprise test) /Oral tests/ Viva/Assignment/Tutorials will be conducted which carries 10% component of the overall evaluation.

Course Outcomes (COs):

At the end of the course, the students will be able to

CO1	find successive differentiation, utilize appropriate theory and computational techniques to construct Taylor's series, use L'Hospital's rule to compute limits of the indeterminate forms.
CO2	Check the convergence of infinite series, perform basic mathematical operations on complex numbers in Cartesian and polar forms, find the n^{th} roots of a complex number and solutions of simple polynomial equations
CO3	find the determinant of a square matrix, evaluate rank and nullity of a matrix, solve system of linear equations by using concept of matrices which are useful in various fields of engineering.
CO4	evaluate partial derivatives including higher order derivatives, solve problems using the chain rules, Euler's theorem with corollaries, implicit function and total differentials.
CO5	expand any function of two variables in ascending power of variables, solve problems using the techniques of multivariable calculus in various branches of engineering.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	2	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	1	-	-	-	-	-	-	-	-	-
CO5	3	2	1	1	1	-	-	-	-	-	-	-	-	-

Correlation levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Recommended Study Material:

❖ **Text Books:**

1. Erwin Kreyszig; Advanced Engineering Mathematics, 8th Ed., Jhon Wiley & Sons, India, 1999.
2. H. K. Dass and RajnishVerma; Higher Engineering Mathematics, S Chand & Co Pvt Ltd. 2012.
3. B. S. Grewal; Higher Engineering Mathematics, Khanna Publ., Delhi, 2012

❖ **Reference Books:**

1. M. D. Weir *et al.;* Thomas' Calculus, 11th Ed., PearsonEducation, 2008.
2. James Stewart; Calculus Early Transcendental, 5th Ed., Thomson India, 2007
3. C. R. Wylie and L. C. Barrett; Advanced Engineering Mathematics. 1982., McGraw-Hill Book Company.
4. Michael D. Greenberg; Advanced Engineering Mathematics. Prentice-Hall, 1988.

URL Links:

1. https://ocw.mit.edu/ans7870/resources/Strang/Edited/Calculus/Calculus.pdf
2. http://nptel.ac.in/courses/111107108/
3. http://nptel.ac.in/courses/122101003/
4. http://nptel.ac.in/courses/111104085/