CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY
FACULTY OF APPLIED SCIENCES
MA144: ENGINEERING MATHEMATICS – II
B. TECH. 2nd SEMESTER (For all branches)

Credits and Hours:

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

A. Objective of the Course:

A good engineer has to have an excellent background of Mathematics. Engineering Mathematics is one of the essential tools for learning technology, engineering and sciences. This course lays the foundation for engineering Mathematics in subsequent semesters, so that students get a sound knowledge and important aspects of the course. The objectives of the course are to understand concept of :

- differential equations, partial differential equations and its solutions
- multiple integration and solution techniques
- Matrix Algebra
- basic probability and statistics

B. Outline of the course:

Sr. No.	Title of the unit	Number of hours
1.	First order and First degree Ordinary Differential Equations	08
2.	Higher Order Ordinary Linear Differential Equations	12
3.	Partial Differential Equations and Applications	10
4	Matrix Algebra –II	10
5.	Improper and Multiple Integrals	10
6.	Probability and Statistics	10
	Total hours	**60**

C. Detailed Syllabus:

		Hours (%)
1.	**First order and First degree Ordinary Differential Equations:**	08 (13)
1.1	Modeling of real world problems in terms of first order ODE	
1.2	Concept of general and particular solutions	
1.3	Initial value problems	
1.4	Existence and Uniqueness of solutions by illustrations	
1.5	Solutions of first order and first degree differential equations	
1.6	Linear, Bernoulli,Exact and non-exact differential equations	
2.	**Higher Order Ordinary Linear Differential Equations:**	12 (20)
2.1	Model of real world problems of higher order LDE	
2.2	General Solution of Higher Order Ordinary Linear Differential Equations with Constant coefficients	
2.3	Methods for finding particular integrals viz. variation of parameters and undetermined coefficients	
2.4	LDE of higher order with variable coefficients: Legendre's Equations (Special case: Cauchy-Euler equation)	
2.5	System of simultaneous first order linear differential equations	
3.	**Partial Differential Equations and Applications:**	10 (17)
3.1	Boundary valued problems	
3.2	Methods of solutions of first order PDE	
3.3	Lagrange's Linear Partial Differential Equations.	
3.4	Special types of Nonlinear PDE of the first order	
3.5	Solutions of Heat, Wave and Laplace equations using separation of variables.	
3.6	Modeling of real world problem in terms of PDE	
4.	**Matrix Algebra –II:**	10 (17)
4.1	Revision of matrices, determinant	
4.2	Eigenvalues and Eigenvectors of matrices	
4.3	Eigenvalues and Eigenvectors of special matrices	
4.4	Cayley-Hamilton's Theorem and its applications.	
4.5	LU decomposition	
5.	**Improper and Multiple Integrals:**	10 (17)
5.1	Improper integrals and their convergence	
5.2	Definitions, properties and examples of Gamma, Beta and Error functions	
5.3	Evaluation of double and triple integrals	
5.4	Change of order of double integration	
5.5	Transformation to polar and cylindrical coordinates	
5.6	Applications of double and triple integrals	

6.	**Probability and Statistics:**	10 (16)
6.1	Mean, median, mode and standard deviation	
6.2	Combinatorial probability	
6.3	Joint and Conditional probability and Bayes theorem	
6.4	Random variables, probability distribution functions - Binomial, Poisson, exponential and normal.	

D. 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.

E. Student Learning Outcomes

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

CO1	formulate models of natural phenomena using differential equations and find its solution using standard methods.
CO2	identify, analyze and subsequently solve physical problems analytically whose behaviour can be described by linear and nonlinear differential equations.
CO3	find and explain significant of Eigenvalues and Eigenvectors of a square matrix, use Cayley-Hamilton's theorem to find inverse and power of a square matrix, construct LU decomposition of a square matrix.
CO4	use advanced techniques to evaluate improper integrals, apply multiple integrals to find area, volume and mass in engineering field.
CO5	recognize the difference between different measure of central tendency, summarize and interpret data.
CO6	understand and solve the problems using probability axioms, rules and Bayes theorem, use distributions such as Binomial, Poisson, Exponential and Normal to solve real world problems.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	3	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	1	-	-	-	-	-	-	-	-	-	-	2	-
CO5	2	2	-	1	1	-	-	-	-	-	-	-	2	1
CO6	2	2	1	2	1	1	1	-	-	-	-	-	2	1

Correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

F. Recommended Study Material:

- Text Books:
  1. Erwin Kreyszig; Advanced Engineering Mathematics, 8th Ed., Jhon Wiley & Sons, India, 1999.
  2. H. K. Dass and Rajnish Verma; Higher Engineering Mathematics, S Chand & Co Pvt. Ltd.
  3. Sheldon Ross; A first course in probability. Pearson, 2014.
  4. B. S. Grewal; Higher Engineering Mathematics, Khanna Publ., Delhi, 2012
- Reference Books:
  1. M. D. Weir et al; Thomas' Calculus, 11th Ed., Pearson Education, 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.
  5. R. V. Hogg, E. A. Tanis and D. L. Zimmerman; Probability and Statistical Inference, 9th edition, Prentice Hall, 2015.
  6. Zafar Ahsan; Differential Equations and Their Applications, φ Learning, Pvt Ltd,Third Edition (2017).
- URL Links:
  1. http://nptel.ac.in/courses/122107037/
  2. http://nptel.ac.in/courses/111107108/
  3. http://nptel.ac.in/courses/122103012/
  4. http://nptel.ac.in/courses/122104018/
  5. http://nptel.ac.in/courses/111106100/
  6. http://nptel.ac.in/courses/122101003/
  7. https://ocw.mit.edu/courses/mathematics/18-02-multivariable-calculus-fall-2007/lecture-notes/
  8. https://nptel.ac.in/courses/111105041/