

Subject Code: 01MA1151

Subject Name: Matrix algebra and vector calculus

B.Tech. (Sem-II)

Objective: This subject aims to provide fundamentals of matrix algebra and vector calculus. The topics delivered in the paper are essential for almost all science and engineering disciplines.

Credits Earned: 5 Credits

Course Outcomes: After completion of this course, understudy will have the capacity to

- Explain the linear dependence of vectors of different vector space.
- Apply Gauss elimination to solve linear system of equations.
- Apply the concept of Eigen values and vectors in various field of engineering like control theory, vibration analysis, quantum mechanics etc.
- Understand role of mathematical modeling in taking care of different issues related to heat transfer, mechanics, momentum, etc.
- Understand the key role of vector integral calculus in finding flux in vector field, finding potential function, etc.
- Determine convergence of improper integrals and explain special functions like Beta, Gama and error functions.
- Gain the fundamental knowledge about special function like Beta and Gamma and its applications.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	Mid Sem (M)	Internal (I)	Viva (V)	Term work (TW)	
4	2	-	5	50	30	20	25	25	150

Contents:

Unit	Topics	Contact Hours
1	Vector space: Vector space, Linear independence of vectors, Basis and dimension of vector space, Inner product spaces and their properties.	7
2	Matrix Algebra - I: Rank and nullity of a matrix, Determination of rank by row operation, Triangularization of matrices by Gauss-elimination process, Computing inverse of a matrix by Row operations, Consistency of system of linear equations.	7
3	Matrix Algebra-II: Determinant and their properties, Cofactors of $n \times n$ determinant, Eigen values and eigen vector of matrix, Cayley - Hamilton theorem, Quadratic and Canonical forms, special matrices and their properties.	7
4	Vector differential calculus: Recall the concept of vector algebra, Scalar and vector functions, gradient of a scalar point functions, Divergence and Curl of a vector point function, Physical meaning of gradient, divergence and curl, directional derivatives, Conservative vector fields, Irrotational and Solenoidal function.	10
5	Vector Integral calculus: Line integrals, Path Independence of Line Integrals, Concept of surface integrals, Green's theorem, Stoke's theorem and Divergence theorem.	10
6	Improper integrals Improper integrals of type I and type – II, Convergence of Improper integrals, Beta, Gamma and error functions with properties.	10
	Total Hours	51

Recommended Textbooks:

1. M. D. Weir *et al*: Thomas' Calculus, 11th Ed., Pearson Education, 2008.
2. Stewart James: Calculus Early Transcendental, 5th Ed., Thomson India, 2007
3. Wylie & Barrett: Advanced Engineering Mathematics, McGraw-Hill pub.
4. Greenberg M D: Advanced Engineering Mathematics, 2nd ed., Pearson
5. Erwin Kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley, INC
6. H. K. Dass, Advanced Engineering Mathematics, S Chand Publishing.

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	20%	30%	15%	10%	5%

Instructional Method:

- a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- c. Practical examination will be directed toward the completion of semester for assessment of performance of understudies in laboratory.
- d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

Supplementary Resources:

1. <http://mathworld.wolfram.com/>
2. <http://en.wikipedia.org/wiki/Math>