

Course Code	Course Title	L	T	P	C
BAMAT205	Discrete Mathematics and Linear Algebra	3	1	0	4
Pre-requisite	Multivariable Calculus and Differential Equations	Syllabus Version			
		1.1			
Course Objectives					
1. To develop logical reasoning and problem-solving skills by understanding mathematical logic, inference theory, and predicate calculus for engineering applications. 2. To apply counting techniques, algebraic structures, and lattice theory to optimize combinatorial problems and system designs in engineering. 3. To utilize vector spaces, linear transformations, and inner product spaces for efficient representation, computation, and analysis in engineering modeling and simulations.					
Course Outcomes					
At the end of this course, the student is able to 1. apply proof techniques in solving logical problems 2. solve engineering problems involving counting principles. 3. relate algebraic structures to enhance problem-solving techniques. 4. understand the concepts of vector space, subspaces and linear transformations. 5. apply vector normalization techniques to generate orthonormal basis.					
Module:1	Mathematical Logic	9 hours			
Statements and Notation-Connectives–Tautologies-Equivalence - Implications–Normal forms - The Theory of Inference for the Statement Calculus - Predicate Calculus – Inference Theory of the Predicate Calculus. Applications: <i>Validity of Algorithms by Inference</i>					
Module:2	Counting Techniques	8 hours			
Basics of counting-Pigeonhole principle- Permutations and combinations-Inclusion-exclusion principle-Recurrence relations - Solving recurrence relations-Generating functions. Applications: <i>Analyzing Recursive Functions, Complexity of Algorithms</i>					
Module:3	Algebraic Structures and Lattices	8 hours			
Groups – Subgroups – Lagrange’s Theorem Homomorphism –Properties- Partially Ordered Relations -Lattices as Posets – Hasse Diagram – Properties of Lattices. Boolean Algebra. Applications: <i>Coding Theory -Error Correction and Detection in Communication.</i>					
Module:4	Vector Spaces and Linear Transformations	10 hours			
The Euclidean space R^n Vector space and subspace, linear combination, span, linear dependence and independence, basis and dimension. Row space, column space, null space, and Rank-Nullity Theorem. Linear transformations – definition, properties, matrix representation, invertibility, and change of basis. Applications: <i>Computer Graphics - Rotation, Scaling and Translations, JPEG & MPEG Compression.</i>					
Module:5	Inner Product Spaces	8 hours			
Dot and inner products, length of a vector, angle between vectors, and matrix representation of inner products. Gram-Schmidt orthogonalization, orthonormal basis. Quadratic forms and their nature – positive definite, negative definite, and indefinite forms. Applications: <i>Modeling Signals with Orthonormal Basis, Computer Vision.</i>					

Module:6	Contemporary Topics			2 hours
	Total Lecture hours:			45 hours
	Total Tutorial hours:			15 hours
Text Book(s)				
1.	J.P.Trembley and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, 2017, 35 th Reprint, Tata Mc Graw Hill, New Delhi.			
2.	Stephen Andrilli and David Hecker, Elementary Linear Algebra, 5th Edition, Academic Press, 2016			
Reference Books				
1.	Kenneth H. Rosen, Discrete Mathematics and its applications, 2019, 8th Edition, Tata McGraw Hill, Noida.			
2.	Gilbert Strang, Introduction to Linear Algebra, 2023, 6th Edition, Wellesley- Cambridge Press.			
Mode of Evaluation: Quizzes, Assignments, CATs and FAT				
Recommended by Board of Studies			14-May-2025	
Approved by Academic Council				Date