Programme	B. Sc. Mathematics Honours			
Course Code	MAT2MN105			
Course Title	**VECTOR SPACES AND LINEAR TRANSFORMATIONS**			
Type of Course	**Minor**			
Semester	II			
Academic Level	100 – 199			
Course Details	Credit	Lecture/Tutorial per week	Practical per week	Total Hours
	4	4		60
Pre-requisites	Linear Algebra Course in Semester 1-Vectors and Matrices			
Course Summary	This course delves into advanced concepts in linear algebra, focusing on general vector spaces, basis and dimension, matrix transformations, and eigenvalues and diagonalization. The course builds on foundational linear algebra principles and explores their applications in higher-dimensional spaces and complex transformations.			

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the fundamental concepts of vector spaces and subspaces.	U	C	Internal Exam/ Assignment/ Seminar/ Viva/ End Sem Exam
CO2	Apply the concepts of linear independence, coordinates, basis and dimension within the vector spaces.	Ap	P	Internal Exam/ Assignment/ Seminar/ Viva/ End Sem Exam
CO3	Analyse and apply basic matrix transformations.	An	C	Internal Exam/ Assignment/ Seminar/ Viva/ End Sem Exam
C04	Explore concepts of eigen values, eigen vectors and diagonalization of matrices.	Ap	C	Internal Exam/ Assignment/ Seminar/ Viva/ End Sem Exam
C05	Analyse and apply the concepts of linear transformations and their properties.	An	P	Internal Exam/ Assignment/ Seminar/ Viva
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Text: Howard Anton and Chriss Rorres, Elementary Linear Algebra (11/e), Applications version, Wiley				
Module	**Unit**	**Content**	**Hrs (60)**	**Ext. Marks (70)**
I		**General Vector Spaces**	**12**	
	1	Section 4.1: -Real vector spaces – up to and including Example 8.		
	2	Section 4.1:- Rest of the section.		
	3	Section 4.2: - Subspaces (examples 7, 8 are optional) – up to and Example 10.		
	4	Section 4.2: - From Example 10 to Example 15 (proof of theorem .4.2.3 is optional)		
	5	Section 4.2: - Rest of the section (Linear transformation view point is optional)		
II		**Basis And Dimension**	**12**	
	6	Section 4.3: - Linear independence – up to and including Theorem 4.3.3		
	7	Section 4.3: - Rest of the section (proofs of all the results are optional).		
	8	Section 4.4:- Coordinates and Basis -up to and including Example 5		
	9	Section 4.4: - rest of the section from Theorem 4.4.1.		
	10	Section 4.5:-Dimension – up to and including Example 3.		
	11	Section 4.5: - Rest of the section from Example 3 (proofs of all the theorems are optional).		
III		**Matrix Transformations**	**12**	
	12	Section 4.9: - Basic matrix transformations in R^2 and R^3- Reflection operators, Projection operators		
	13	Section 4.9:- Rotation Operators – Rotation in R^3		
	14	Section 4.9:- Rest of the section.		
	15	Section 4.10: - Properties of Matrix Transformations – up to and including Example 4.		
	16	Section 4.10:- rest of the section (proofs of theorems are optional)		
	17	Section 4.11: - Geometry of Matrix Operators on R^2 (proof of Theorem 4.11.2 is optional)		
IV		**Eigen Values and Diagonalization**	**12**	
	18	Section 5.1:- Eigen values and eigen vectors – up to Theorem 5.1.3		
	19	Section 5.1; -From Theorem 5.1.3 to Example 7 (including)		
	20	Section 5.1: - Rest of the section (Eigen values of general linear transformation is optional)		
	21	Section 5.2: - Diagonalization – up to and including Example 4 (proofs of theorems are optional)		
	22	Section 5.2; - Rest of the section (Geometric and algebraic multiplicity are optional)		
V		**OPEN ENDED**	**12**	
	Rank space, Null space and Rank- Nullity theorem, General Linear transformations and Matrix representation, Geometric and Algebraic multiplicity.			

References:

1 Advanced Engineering Mathematics, 6th Edition, Dennis G. Zill, Jones & Bartlett Learning LLC (2018) ISBN: 978-1-284-10590-2.
2. Advanced Engineering Mathematics, Erwin Kreyzsig, 10th Edition, Wiley India.
3. Linear Algebra and its Applications: 3rd Edition, David C. Lay, Pearson Publications

Note: 1) Optional topics are exempted for end semester examination. (2) Proofs of all the results are exempted for external exam. (3) 70 external marks are distributed over the first four modules subjected to a minimum of 15 marks from each module.

Mapping of COs with POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	0	2	1	3	0	2
CO 2	3	0	2	1	3	0	2
CO 3	3	0	2	1	3	0	2
CO 4	3	0	2	1	3	0	2
CO 5	3	0	2	1	3	0	2