

Programme	BSc Mathematics Honours			
Course Title	MATRIX ALGEBRA AND VECTOR CALCULUS			
Course Code	MAT3MN203			
Type of Course	Minor			
Semester	III			
Academic Level	200 – 299			
Course Details	Credit	Lecture/Tutorial per week	Practical per week	Total Hours
	4	4	-	60
Pre-requisites	Basic Calculus and familiarity with Euclidian Geometry.			
Course Summary	This course covers fundamental concepts in vectors, vector calculus, and matrices. Students will explore vectors in 2-space and 3-space, including dot and cross products, as well as lines and planes in 3-space. The vector calculus portion includes vector functions, partial and directional derivatives, tangent planes, normal lines, curl, divergence, line integrals, double integrals, surface integrals, and triple integrals. Additionally, the course delves into matrix algebra, systems of linear equations, matrix rank, and the eigenvalue problem.			

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Discuss the geometry of Vectors in two- and three-dimensional spaces	U	C	Internal Exam/ Assignment/ Seminar/ Viva / End Sem Exam
CO2	Discuss the basic concepts of matrices, and evaluate the solutions of system of linear equations using matrices.	Ap	P	Internal Exam/Assignment/ Seminar/ Viva / End Sem Exam
CO3	Describe the idea of eigen values and eigen vectors.	U	C	Internal Exam/ Assignment/ Seminar/ Viva / End Sem Exam
* - 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: Advanced Engineering Mathematics, 6th Edition, Dennis G. Zill, Jones & Bartlett Learning LLC (2018) ISBN: 978-1-284-10590-2.				
Module	Unit	Content	Hrs (60)	Ext. Marks (70)
I	Vectors		11	Min. 15
	1	Section 7.1-Vectors in 2 -Space (quick review)		
	2	Section 7.2-Vectors in 3-Space (quick review)		
	3	Section 7.3- Dot Product up to and including Example 5		
	4	Section 7.4- Cross Product up to and including Example 3		
	5	Section 7.5- Lines and Planes in 3-space- upto and including Example 6		
	6	Section 7.5- Lines and Planes in 3-space- From Planes: Vector Equation onwards		
II	Vector Calculus		15	Min. 15
	7	Section 9.1 – Vector Functions		
	8	Section 9.4 – Partial Derivatives		
	9	Section 9.5 – Directional Derivative – upto and including Example 4.		
	10	Section 9.5 – Functions of Three Variables onwards.		
	11	Section 9.6 – Tangent Planes and Normal Lines – upto and including Example 4		
	12	Section 9.6 – Topics from Normal Line onwards		
III	Vector Calculus – contd.			Min. 15
	14	Section 9.8 – Line Integrals – upto and including Example 5.		

	15	Section 9.10 – Double Integrals – upto and including Example 2	12	
	16	Section 9.13 – Surface Integrals – upto and including Example 4		
	17	Section 9.15 – Tripple Integrals (Examples 5 and 7 are optional)		
IV	Matrices		10	Min. 15
	18	Section 8.1- Matrix Algebra.		
	19	Section 8.2-Systems of Linear Algebraic Equations. Up to and including Example 7		
	20	Section 8.2-Systems of Linear Algebraic Equations. From Homogeneous Systems onwards till end omit chemical equations		
	21	Section 8.3 -Rank of a Matrix.		
	22	Section 8.8-The Eigenvalue Problem.-Up to and including Example 4		
V	Open Ended		12	
		<p>Vector Spaces, Gram- Schmidt Orthogonalization (for instance, refer sections 7.6 and 7.7)</p> <p>Green’s Theorem, Stocke’s Theorem and Divergence Theorem (for instance, refer sections 9.12, 9.14 and 9.16)</p> <p>Complex Eigen Values</p> <p>Eigen Values and Singular Matrices.</p> <p>Eigen Values and Eigen Vectors of inverse of A</p> <p>Improper Integrals,</p> <p>Beta and Gama Functions</p>		
		<p>References:</p> <p>1. Calculus and Analytic Geometry (9th Edn), George B Thomas, Jr. and Ross L Finney, Addison -Wesley Publishing Company.</p> <p>2. A Freshman Honors Course in Calculus and Analytic Geometry, Emil Artin (Author), Marvin J Greenberg (Foreword).</p>		

		3. Advanced Engineering Mathematics (10 th Edn), Erwin Kreyszig, John Wiley and Sons. 4. Improper Riemann Integrals: Ioannis M. Roussos CRC Press by Taylor & Francis Group, LLC(2014) ISBN: 978-1-4665-8808-0 (ebook -pdf)		
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Note: 1) Optional topics are exempted for end semester examination. 2) Proofs of all the results are also exempted for the end semester exam.

Mapping of COs with PSOs and POs :

	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	1	3	2	3	2	3	1	2
CO 2	3	1	3	2	3	3	3	1	2
CO 3	3	2	3	2	3	2	3	1	2

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/ Seminar
- Internal Exam
- Viva
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Seminar	Viva	End Semester Examinations
CO 1	✓	✓	✓	✓	✓
CO 2	✓	✓	✓	✓	✓
CO 3	✓	✓	✓	✓	✓