University of Kerala

Discipline	Mathematics				
Course Code	UK1DSCMAT106				
Course Title	Number Theory and Linear System of Equations				
Type of Course	DSC				
Semester	I				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical	Total Hours per week
	4	4	-	-	4
Pre-requisites	1. Natural Numbers 2. Matrices				
Course Summary	This course provides a study on number theory and linear system of equations				

Detailed Syllabus

Module	Unit	Contents	Hrs
I		**The Euclidean Algorithm**	**12**
	1	The division algorithm, Pigeonhole principle, divisibility relations, inclusion-exclusion principle (Chapter 2 Sections 2.1, 2.5 of Text [2] The topics from the subsection 'A Number-Theoretic Function' onwards are excluded. But Theorem 2.12 and Lemma 2.25 to be discussed.)	
	2	Prime and composite numbers, infinitude of primes, GCD, linear combination of integers, pairwise relatively prime integers, the Euclidean algorithm for finding GCD (Chapter 3 Section 3.1 of Text [2]. The subsections marked as optional, Theorems 3.1, 3.2, 3.3, 3.12, 3.14, and Lemma 3.2 are excluded.)	

Module	Unit	Contents	Hrs
II		**Congruences**	**12**
	3	The fundamental theorem of arithmetic, canonical decomposition of an integer into prime factors (Chapter 3 Sections 3.3 of Text [2]. The subsections marked as optional, Theorem 3.14 are excluded.)	
	4	LCM (Chapter 3 Section 3.4 of Text [2])	
III		**Matrices and Systems of linear equatios**	**12**
	5	Linear Systems of Equations, Gauss Elimination, Linear Independence, Rank of a Matrix.	
	6	Solutions of Linear Systems: Existence, Uniqueness	
	7	Determinants, Cramer's Rule – 2×2 matrices only (Chapter 7 Section 7.7 of Text [2])	
	Chapter 7: Sections 7.2, 7.4 (avoid vector space), 7.5 omit proofs of theorems of Text [2]		
IV		**Eigen values and Eigen vectors**	**12**
	8	The Matrix Eigenvalue Problem. Determining Eigenvalues and Eigenvectors – 2×2 matrices only	
	9	Symmetric, Skew-Symmetric, and Orthogonal Matrices – 2×2 matrices only	
	10	Diagonalization 2×2 matrices only	
	Chapter 8 Section 8.1, 8.4 except eigen bases of Text [2]		
V		**Suggestions for teacher designed module**	**12**
	For internal assessment examinations only.		
	11	Geometry of linear systems Cramer's rule Diagonalization - – 3×3 matrices Orthogonal Matrices, Quadratic Forms Mathematical induction, recursion, The division algorithm (Chapter 1 Sections 1.3, 1.4 of Text [2]) Congruences, modular exponentiation (Chapter 4 Section 4.1 of Text [2].)	
	These topics can be found on Chapters 1 and 4 of Text [1] and Chapter 7, 8 of Text [2]		

Textbooks

1. Erwin Kreyszig, *Advanced Engineering Mathematics*, Wiley, 10^{th} Edition, 2011.
2. Thomas Koshy, *Elementary Number Theory with Applications*, 2^{nd} Edition, Academic Press, 2007.

References

1. T S Blyth, E F Robertson, *Linear Algebra*, Second Edition, Springer, 2013.
2. David C Lay, *Linaer algebra and its applications*, Pearson, 2003.
3. David M. Burton, *Elementary Number Theory*, 7th Edition, McGraw Hill, 2011.
4. G A Jones, J M Jones, *Elementary Number Theory*, Springer, 1998.
5. Lee W. Johnson, R Dean Riess, Jimmy T. Arnold, *Introduction to Linear Algebra*, Fifth Edition, Addison Wesley, 2019
6. Thomas Banchoff, John Wermer, *Linear Algebra Through Geometry*, 2nd Edition, Springer, 2012.

E-resources

1. https://www.khanacademy.org

Course Outcomes

CO No.	Upon completion of the course the graduate will be able to	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L) Tutorial (T)	Practical (P)
CO 1	Examine integrated approach to number theory	PSO 1, 3, PO2	U	F, C	L	
CO 2	Apply the concept of congruences	PSO 2, 3, 4, PO1, 2, 5, 6	Ap, An	P	L	
CO 3	Understand the concepts of Matrix operations, their algebraic properties, System of linear equations and their Matrix representation, Gauss Elimination	PSO 1, PO1, 2, 5, 6	U	F, C	L	
CO 4	Able to find the eigen values of powers of matrices and diagonalization of matrices	PSO 2, 4, PO1, 2, 6	Ap, An	P	L	

(R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create)
(F-Factual, C-Conceptual, P-Procedural, M-Metacognitive)

Mapping of CO with PSOs and POs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO3	2	-	1	-	-	-	-	1	-	-	-	1	-	-
CO4	-	2	2	1	-	-	1	2	-	-	1	1	-	-
CO3	2	-	-	-	-	-	2	1	-	-	1	2	-	-
CO4	-	2	-	2	-	-	2	2	-	-	-	2	-	-

(- -Nill, 1-Slightly/Low, 2-Moderate/Medium, 3-Substantial/High)

Assessment Rubrics

- Quiz/Assignment/Discussion/Seminar