



University of Kerala

Discipline	Mathematics				
Course Code	UK1DSCMAT100				
Course Title	Foundations of Mathematics				
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. Definition and preliminary results of matrices. 2. Understanding on methods to solve a system of simultaneous equations. 3. Basic knowledge of various number systems.				
Course Summary	This course includes set theory, determinants and matrices, number theory and solution of systems of equations using matrices and number theory				

Detailed Syllabus

Module	Unit	Contents	Hrs
I		Sets-Relations-Functions	12
	1	Sets: Sets and Elements, Subsets, Venn Diagram, Set Operations. Relation: Product sets, Relations, Types of Relations, Equivalence Relations, Partial Ordering Relations Functions: Functions, One-to-One, Onto and Invertible Functions. (Chapter 1: Sections 1.2, 1.3, 1.4, Chapter 2: 2.2, 2.3, 2.6, 2.8, Chapter 3: 3.2, 3.3 of Text [2])	

Module II	Unit	Contents	Hrs
		Matrices and Determinants	12
	2	Definition, Properties of Determinants and problems, Special Matrices Review of Matrix operations and Related Matrices Rank of a matrix-Elementary transformation, Equivalent matrix, Elementary matrices, Normal form (Chapter 1: Section 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7.1 to 2.7.7 of Text [1])	
III		Solution of system of equation	10
	3	Solution of Linear system equation method Cramer's Rule, Matrix Inversion Method Consistency of linear system of equation, Rouche's Theorem (Statement only), System of homogeneous equation (Chapter 2: Sections 2.9, 2.9.1, 2.9.2, 2.10 of Text [1])	
IV		Number Theory	26
	4	Mathematical induction, The division algorithm, Pigeonhole principle, divisibility relations, inclusion-exclusion principle (These topics can be found in Chapter 1 section 1.3, Chapter 2 sections 2.1, 2.5 of Text [3]. The topics from the subsection 'A Number-Theoretic Function' onwards are excluded for examination. But Theorem 2.12 and Lemma 2.25 to be discussed.)	
	5	Prime and composite numbers, infinitude of primes, GCD, linear combination of integers, pairwise relatively prime integers, the Euclidean algorithm for finding GCD the fundamental theorem of arithmetic, canonical decomposition of an integer into prime factors, LCM. (These topics can be found in Chapter 3 sections 3.1 to 3.4 of Text [3]. The subsections marked as optional, Theorems 3.1, 3.2, 3.3, 3.12, 3.14, and Lemma 3.2 are excluded for examination.)	
	6	Congruences, Modular exponentiation. These topics can be found in Chapter 4 sections 4.1 and 4.2 of Text [3]. The subsections marked as optional and 'The monkey and coconut puzzle revisited' are excluded for examination.	

Textbooks

1. B.S. Grewal, Higher Engineering Mathematics, 42nd Edition, Khanna Publishers, 2012

2. Seymour Lipschutz, Marc Lipson. Discrete Mathematics, 3rd Edition, Schaum's outline, 2007.
3. Thomas Koshy, Elementary Number Theory with Applications, 2nd Edition, Academic Press, 2007.

References

1. David M. Burton, Elementary Number Theory, Seventh Edition, McGraw-Hill, 2011.
2. Gilbert Strang, Introduction to Linear Algebra, 5th Edition, 2005.
3. G. A. Jones, J. M. Jones, Elementary Number Theory, Springer, 1998.
4. Lee W. Johnson, R. Dean Riess, Jimmy T. Arnold, Introduction to Linear Algebra, Fifth Edition, Addison Wesley, 2019.
5. Seymour Lipschutz. Set Theory and Related Topics, 3rd Edition, Schaum's outline, 1998

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)
CO1	Describe the basic concept of set theory, determinants, Matrices and numbers	PSO1, PO1, 2, 4, 8	U	F, C	L	
CO2	Solve system of linear equations using determinants, Matrices	PSO2, PO1, 2, 3, 4, 7, 8	Ap	P	L	
CO3	Illustration of Mathematical Induction, Division Algorithm and Euclidean Algorithm	PSO1, PO1, 2, 3, 4, 6, 7, 8	U	F, C	L	
CO4	Categorise functions based on the properties	PSO4, PO1	An	F, C	L	

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



University of Kerala

Discipline	Mathematics				
Course Code	UK2DSCMAT109				
Course Title	Matrices and Linear Equations				
Type of Course	DSC				
Semester	II				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical	Total Hours per week
	4	4	-	-	4
Pre-requisites	Matrices				
Course Summary	This is a brief introductory course on matrices and system of linear equations				

Detailed Syllabus

Module	Unit	Contents	Hrs
I		System of linear equations and matrices	10
	1	Introduction to Systems of Linear Equations, Gaussian Elimination, Matrices and Matrix Operations, Inverses; Algebraic Properties of Matrices, [Section 1.1 to 1.4 of the Text]	
II		Further properties of matrices	15
	2	Elementary matrices and method for finding inverse, more on linear systems and invertible matrices, diagonal, triangular and symmetric matrices, matrix transformations [Section 1.5 to 1.8 of the Text]	
III		Determinants	15
	3	Determinants by cofactor expansion, evaluating determinants by row reduction, properties of determinants, Cramer's rule	

Module	Unit	Contents	Hrs
IV		Euclidean vector spaces	20

	4	Vectors in 2-space, 3-space and n-space, Norm, dot product, and distance in R^n , Orthogonality, the geometry of linear systems, cross product	
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Textbook

1. H Anton, C Rorres. Elementary linear algebra, 11th Edition, John Wiley & Sons, 2013

References

1. David Poole, Linear Algebra, a modern introduction, Brooks/Cole Cengage Learning, 2005.
2. Lee W. Johnson, R. Dean Riess, Jimmy Arnold, Introduction to Linear Algebra, Fifth edition, Addison Wesley, 2019.

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)	Assignment (As)
CO1	Understand system of linear equations	PSO1,2, PO1	U	F,C	L,T	
CO2	Perform various operations on matrices and determinants	PSO2, PO3,4	An	F	L,T	
CO3	Understand the concept of vectors in Euclidean spaces	PSO1,3, PO2, 3	U, An	C	L,T	
CO4	Apply matrices to solve system of linear equations	PSO1,3	Ap	C	L,T	

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University of Kerala

Discipline	Mathematics				
Course Code	UK3DSCMAT211				
Course Title	Discrete Mathematics				
Type of Course	DSC				
Semester	III				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours per week
	4	4 hours	0	0	4
Pre-requisites	Knowledge of basic set theory				
Course Summary	This course includes Mathematical Logic, Predicate logic and Algebraic Structures				

Detailed Syllabus

Module	Unit	Contents	Hrs
I		Mathematical Logic	15
	1	Proposition and Connectives, Conditional and bi-conditional, Equivalence of proposition (<i>These topics can be found in Chapter 1 of Text [2]</i>)	
	2	Tautology and Contradiction, Logical implications well-formed formula, Algebra of proposition (<i>These topics can be found in Chapter 1 of Text [2]</i>)	
	3	DeMorgan's law, Duality theorem (<i>These topics can be found in Chapter 1 of Text [1]</i>)	
II		Proof Methods and Logic	15
	4	Formal Proof, Propositional reasoning by contradiction, indirect method of proof (<i>These topics can be found in Chapter 1 of Text [2]</i>)	

Module	Unit	Contents	Hrs
	5	Boolean expressions, Normal forms-Disjunctive normal form, Conjunctive normal form, Principal Conjunctive Normal forms and principal disjunctive normal forms using truth table only (<i>These topics can be found in Chapter 1 of Text [2]</i>)	
III	Algebraic Structures		15
	6	Algebra, DeMorgan's Law, Group, Subgroup examples and simple properties (<i>These topics can be found in Text [1]</i>)	
	7	Communication Model - coding theory, error corrections, Hamming Codes (Avoid computer programs) (<i>These topics can be found in Text [1]</i>)	
IV	Predicate Logic		15
	8	Quantifiers: Essential and Universal quantifier, Free and Bound Variables (<i>These topics can be found in Chapter 1 of Text [2]</i>)	
	9	Rules of Specifications: Rule US, ES, UG, EG. Using these, convert a given statement into symbolic notation (<i>These topics can be found in Chapter 1 of Text [2]</i>)	
	10	Derivation from Premises using truth table (<i>These topics can be found in Chapter 1 of Text [2]</i>)	

Textbooks

1. R. M. Somasundaram, *Discrete Mathematical Structures*, Prentice Hall of India, 2003.
2. T. Veerarajan, *Discrete Mathematics with Graph Theory and Combinatorics*, Tata McGraw Hill, 2007.

References

1. C. L. Liu, D. P. Mohapatra, *Elements of Discrete Mathematics, A Computer oriented approach*, Tata McGraw-Hill, 2008
2. Rajendra Akerkar, Rupali Akerkar, *Discrete Mathematics*, Pearson Education, 2007.
3. B. V. Senthil Kumar and Hemen Dutta, *Discrete Mathematical Structures*, CRC Press, 2020

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)
CO1	Identify the concepts needed to test the logic of a programme	PSO 1, 2, PO1, 2, 4, 6	R,U	F,C	L	
CO2	Explain the underline concepts and tools to solve problems	PSO 2, 3, PO1, 2, 3, 4,6	U	F,C	L	
CO3	Examine accurate and efficient use of algebraic techniques	PSO 4, PO1, 2, 3, 4,6	An	C	L	
CO4	Understand the basic rules of predicate logic	PSO 1, PO1, 2, 3, 4,6	R,U	F,C	L	

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