Course Code	18MAB302T	Course Name	DISCRETE MATHEMATICS FOR ENGINEERS	Course Category	B	Basic Sciences	L	T	P	C
							3	1	0	4

Pre-requisite Courses	18MAB102T	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mathematics	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning
CLR-1 :	Enhance the mathematical skills by applying the principles of sets and functions in storage, communication and processing the data	
CLR-2 :	Culminate in extensive use and application of counting strategies in enumeration of data	
CLR-3 :	Apply the rules of inference theory to design electronic circuits and to verify computer programs	
CLR-4 :	Apply the knowledge of algebraic structures and coding theory to solve problems on detection and correction of errors occurring in binary communication channels	
CLR-5 :	Acquire knowledge to solve problems in communication networks using graph models	
CLR-6 :	Apply the concepts of discrete structures to solve problems in Electrical, Communication and Computer Science Engineering	

Course Outcomes (CO):	At the end of this course, learners will be able to:	Blooms level (1 - 6)
CO-1 :	Apply the concepts of set theory and its operations in data structures and mathematical modelling languages	4
CO-2 :	Solve problems using counting techniques and understanding the basics of number theory	4
CO-3 :	Comprehend and validate the logical arguments using concepts of inference theory	4
CO-4 :	Inculcate the curiosity for applying the concepts of algebraic structures to coding theory	4
CO-5 :	Apply graph theory techniques to solve wide variety of real world problems	4
CO-6 :	Acquire knowledge in mathematical reasoning, combinatorial analysis and discrete structures	4

Program Outcomes (PO)											
1	2	3	4	5	6	7	8	9	10	11	12
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning
3	3	-	-	-	-	-	-	-	-	-	-
3	3	-	-	-	-	-	-	-	-	-	-
3	3	-	-	-	-	-	-	-	-	-	-
3	3	-	-	-	-	-	-	-	-	-	-
3	3	-	-	-	-	-	-	-	-	-	-
3	3	-	-	-	-	-	-	-	-	-	-

		Learning Unit / Module 1	Learning Unit / Module 2	Learning Unit / Module 3	Learning Unit / Module 4	Learning Unit / Module 5
Duration (hour)		12	12	12	12	12
S-1	SLO-1	Sets and examples. Operations on sets.	Permutation and Combination	Propositions and Logical operators	Binary operation on a set- Groups and axioms of groups.	Basic concepts - Basic Definitions- degree and Hand shaking theorem.
	SLO-2	Laws of Set theory- Proving set identities using laws of set theory.	Simple problems using addition and product rules.	Truth values and truth tables.	Properties of groups.	Some Special Graphs – complete, regular and bipartite graphs.
S-2	SLO-1	Partition of a set – examples.	Principle of inclusion and exclusion	Propositions generated by a set- Symbolic writing using conditional and biconditional connectives.	Permutation group, equivalence classes with addition modulo m and multiplication modulo m.	Isomorphism of graphs – necessary conditions.
	SLO-2	Cartesian product of sets.	Problems using inclusion and exclusion principle.	Writing converse inverse and contra positive of a given conditional.	Cyclic groups and properties.	Isomorphism- simple examples.
S-3	SLO-1	Relations – Properties.	Pigeon-hole principle and generalized pigeon-hole principle.	Tautology, contradiction and contingency-examples.	Subgroups and necessary and sufficiency of a subset to be a subgroup.	**Paths, cycles and circuits.**
	SLO-2	Equivalence relation and partial order relation	Problems on pigeon-hole principle.	Proving tautology and contradiction using truth table method.	**Group homomorphism and properties.**	***Connectivity in undirected graphs – connected graphs and odd degree vertices.***

S-4	SLO-1	**Problem solving using tutorial sheet 1**	**Problem solving using tutorial sheet 4**	**Problem solving using tutorial sheet 7**	**Problem solving using tutorial sheet 10**	**Problem solving using tutorial sheet 13**
	SLO-2	**Problem solving using tutorial sheet 1**	**Problem solving using tutorial sheet 4**	**Problem solving using tutorial sheet 7**	**Problem solving using tutorial sheet 10**	**Problem solving using tutorial sheet 13**
S-5	SLO-1	Poset - Graphs of relations Digraphs	Divisibility and prime numbers.	Equivalences – truth table method to prove equivalences.	Rings- definition and examples..Zero devisors.	Eulerian and Hamiltonian graphs.
	SLO-2	Hasse diagram – problems.	Fundamental theorem of arithmetic – problems.	Implications- truth table method to prove implications.	Integral domain- definition , examples and properties.	Necessary and sufficient condition for a graph to be Eulerian- examples.
S-6	SLO-1	*Closures of relations- examples*	Finding prime factorization of a given number.	Laws of logic and some equivalences.	Fields – definition, examples and properties.	Matrix representation of graphs- adjacent and incidence matrices and examples.
	SLO-2	Transitive closure and warshall's algorithm	Some more problems using fundamental theorem of arithmetic.	Proving equivalences and implications using laws of logic.	Coding Theory – Encoders and decoders-Hamming codes.	Isomorphism using adjacency.
S-7	SLO-1	Functions – definitions, domain and range of a function - examples	Division algorithm- greatest common divisorand properties-problems.	Rules of inference – Rule P, Rule T and Rule CP	Hamming distance. Error detected by an encoding function.	***Digraphs – in degree and out degree – Hand shaking theorem.***
	SLO-2	Types of functions- one- one and onto- bijection- examples.	**Euclid's algorithm for finding GCD(a,b)-examples..**	Direct proofs	examples.	***Verification of hand shaking theorem in digraphs.***
S-8	SLO-1	**Problem solving using tutorial sheet 2**	**Problem solving using tutorial sheet 5**	**Problem solving using tutorial sheet 8**	**Problem solving using tutorial sheet 11**	**Problem solving using tutorial sheet 14**
	SLO-2	**Problem solving using tutorial sheet 2**	**Problem solving using tutorial sheet 5**	**Problem solving using tutorial sheet 8**	**Problem solving using tutorial sheet 11**	**Problem solving using tutorial sheet 14**
S-9	SLO-1	Composition of functions – examples.	**Problems using Euclid's algorithm.**	**Problems using direct method.**	**Error correction using matrices.**	**Graph colouring – chromatic number-examples.**
	SLO-2	Associatiivity of composition of functions – Identity and inverse of functions.	**Least common Multiple(LCM)- relation between LCM and GCD.**	**Problems using CP rule.**	**Problems on error correction using matrices.**	**Four colour theorem(statement only) and problems.**
S-10	SLO-1	Necessary and sufficiency of existence of inverse of a function.	**Problems on LCM.**	Inconsistency and indirect method of proof.	Group codes-error correction in group codes-parity check matrix.	Trees – definitions and examples. Properties.
	SLO-2	Uniqueness of identity	**Finding LCM and GCD using prime factorization.**	Inconsistent premises and proof by contradiction (indirect method).	Problems on error correction in group codes.	Properties continued.
S-11	SLO-1	Inverse of composition	**Finding GCD and LCM using Euclid's algorithm.**	Principle of mathematical induction.	Procedure for decoding group codes.	Spanning trees – examples.
	SLO-2	Checking if a given function is bijection and if so, finding inverse, domain and range- problems.	**More problems on GCD and LCM.**	Problems based on Mathematical Induction	Problems on decoding group codes.	Kruskal's algorithm for minimum spanning trees.
S-12	SLO-1	**Problem solving using tutorial sheet 3**	**Problem solving using tutorial sheet 6**	**Problem solving using tutorial sheet 9**	**Problem solving using tutorial sheet 12**	**Problem solving using tutorial sheet 15**
	SLO-2	**Applications of sets, relations and functions in Engineering.**	**Applications of sets, relations and functions in Engineering.**	**Applications of sets, relations and functions in Engineering.**	**Applications of sets, relations and functions in Engineering.**	**Applications of sets, relations and functions in Engineering.**

Learning Resources	1.	Kenneth H.Rosen, Discrete Mathematics and its Application, Seventh edition, Tata McGraw-Hill Publishing company PVT .Ltd., New Delhi, 2012.
	2.	Tremblay J. P. and Manohar R., Discrete Mathematical Structures with applications to Computer Science, Tata McGraw Hill Publishing Co., 35th edition,2008.
	3.	NarsingDeo, Graph Theory with applications to Engineering and Computer science, Prentice-Hall of India pvt. Ltd., New Delhi, 2004.
	4.	C.L. Liu, Elements of Discrete Mathematics, 4th Edition, McGraw Higher ED, 2012.
	5.	T.Veerarajan, Discrete Mathematics with Graph Theory and Combinatorics, Tata McGraw Hill, 2015.

	Learning Assessment										
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%		20%		20%		20%		20%	
Level 2	Understand	20%		20%		20%		20%		20%	
Level 3	Apply	30%		30%		30%		30%		30%	
Level 4	Analyze	30%		30%		30%		30%		30%	
Level 5	Evaluate	-		-		-		-		-	
Level 6	Create	-		-		-		-		-	
	Total	100 %		100 %		100 %		100 %		100 %	

 # CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,
SLO – Session Learning Outcome

Course Designers							
(a) Experts from Industry							
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To emerge as a World - Class University in creating and disseminating knowledge, and providing students a unique learning experience in Science, Technology, Medicine, Management and other areas of scholarship that will best serve the world and betterment of mankind.
MOVE UP through international alliances and collaborative initiatives to achieve global excellence.

10/1/23
(Dr. D.K. Sheena Christy)
Course Coordinator

HOD/MATHS 10/01/2023