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

Pre-requisite Courses	18MAB101T	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:
CLR-1 :	Apply set theory, functions and relations in storage, communication and manipulation of data
CLR-2 :	Apply number theory concepts in computer engineering such as public key crypto system.
CLR-3 :	Apply mathematical reasoning in computer science such as design of computer circuit, verification of programs.
CLR-4 :	Learning about groups, rings and fields. Solving problems on coding theory.
CLR-5 :	Using graph models in computer network and shortest path problems Apply graph coloring in problems involving scheduling and assignments.
CLR-6 :	Apply mathematical reasoning, combinatorial analysis, algebraic structures and graph theory in solving mathematical problems as applied to the respective branches of Engineering.

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)													
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	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	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	Problem solving in sets, relations and functions.	3	85	80	M	H	L						M	L		H			
CLO-2 :	Solving problems in basic counting principles, inclusion exclusion and number theory.	3	85	80	M	H		M	M				M			H			
CLO-3 :	Solving problems of mathematical logic, inference theory and mathematical induction.	3	85	80	M	H							M			H			
CLO-4 :	Gaining knowledge in groups, rings and fields. Solving problems in coding theory.	3	85	80	M	H		M					M			H			
CLO-5 :	Gaining knowledge in graphs and properties. Learning about trees, minimum spanning trees and graph coloring.	3	85	80	M	H	L						M	L		H			
CLO-6 :	Learning mathematical reasoning, combinatorial analysis, algebraic structures and graph theory.	3	85	80	M	H							M			H			

		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					
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 divisor and 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					
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					
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 Mc Graw Hill Publishing Co., 35th edition,2008.				
		3. Narsing Deo, 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	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

Course Designers

(a) Experts from Industry

1	*Mr.V.Maheshwaran*	*CTS, Chennai*	*maheshwaranv@yahoo.com*				

(b) Experts from Higher Technical Institutions

2	*Dr.K.C.Sivakumar*	*IIT, Madras*	*kcskumar@iitm.ac.in*	3	*Dr.Nanjundan*	*Bangalore University*	*nanzundan@gmail.com*

(b) Internal Experts

4	*Dr.A.Govindarajan*	*SRMIST*	govindarajan.a@ktr.srmuniv.ac.in	5	*Dr.N. Parvathi*	*SRMIST*	*parvathn@srmist.edu.in*

Course Code	18CSC301T	Course Name	FORMAL LANGUAGE AND AUTOMATA	Course Category	C	Professional Core	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	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	PSO - 1	PSO - 2	PSO – 3
CLR-1 :	*Utilize the mathematics and engineering principles for the basics of Formal Language*																		
CLR-2 :	*Acquire knowledge of Automata and minimize with Regular language's*																		
CLR-3 :	*Acquire knowledge of Context free Grammar and simplify using normal forms*																		
CLR-4 :	*Gain knowledge to push down automata and apply it with CFL*																		
CLR-5 :	*Analyze the methods of turning machine*																		
CLR-6 :	*Analyze and Design the methods of computational complexity*																		
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*																		
CLO-1 :	*Acquire the knowledge of mathematics and engineering principles for the basics of Formal Language*				*M*	*H*	-	*H*	*L*	-	-	-	*L*	*L*	-	*H*	-	-	-
CLO-2 :	*Acquire the ability to identify specification of a Regular language's with Automata*				*M*	*H*	*L*	*M*	*L*	-	-	-	*M*	*L*	-	*H*	-	-	-
CLO-3 :	*Acquire knowledge of Context free Grammar and simplify using normal forms*				*M*	*H*	*M*	*H*	*L*	-	-	-	*M*	*L*	-	*H*	-	-	-
CLO-4 :	*Understand the concepts of push down automata and CFL .*				*M*	*H*	*M*	*H*	*L*	-	-	-	*M*	*L*	-	*H*	-	-	-
CLO-5 :	*Apply the knowledge to turning machine and its methods*				*H*	*H*	*M*	*H*	*L*	-	-	-	*M*	*L*	-	*H*	-	-	-
CLO-6 :	*Design the computational and acceptor machines using FA, PDA and Turing machines*				*L*	*H*	-	*H*	*L*	-	-	-	*L*	*L*	-	*H*	-	-	-

Duration (hour)		**11**	**9**	**9**	**9**	**7**
S-1	SLO-1	*Introduction to Automaton*	*Grammars: Introduction: Types of Grammar*	*Pushdown Automata: Definitions Moves*	*Turing Machines: Introduction*	*Undecidability :Basic definitions*
	SLO-2	*Mathematical concepts*	*Context Free Grammars and Languages*	*Instantaneous descriptions*	*Formal definition of Turing machines, Instantaneous descriptions*	*Decidable problems,*
S-2	SLO-1	*Formal Languages: Strings, Languages, Properties*	*Derivations*	*Deterministic pushdown automata*	*Turing Machine as Acceptors*	*Examples of undecidable problems and Problems*
	SLO-2	*Finite Representation : Regular Expressions*	*Ambiguity*	*Problems related to DPDA*	*Problems related to turning machine as Acceptors*	*Rice's Theorem*
S-3	SLO-1	*Problems related to regular expressions*	*Relationship between derivation and derivation trees*	*Non - Deterministic pushdown automata*	*Problems related to turning machine as Acceptors*	*Undecidable problems about Turing Machine- Post's Correspondence Problem*
	SLO-2	*Finite Automata :Deterministic Finite Automata*	*Problems related to Context free Grammar*	*Problems related to NDPDA*		*Problems related to Post's Correspondence Problem*
S-4	SLO-1	*Nondeterministic Finite Automata*	*Simplification of CFG : Elimination of Useless Symbols*	*Problems related to DPDA and NDPDA*	*Turing Machine as a Computing Device*	*Properties of Recursive and Recursively enumerable languages*
	SLO-2	*Finite Automaton with €- moves*			*Problems related to turning Turing Machine as a Computing Device*	
S-5	SLO-1	*Problems related to Deterministic and Nondeterministic Finite Automata*	*Simplification of CFG : Unit productions*	*Pushdown automata to CFL Equivalence*	*Problems related to turning Turing Machine as a Computing Device*	*Introduction to Computational Complexity: Definitions*
	SLO-2	*Problems related to Finite Automaton with €- moves*	*Simplification of CFG : Null productions*	*Problems related to Equivalence of PDA to CFG*		*Time and Space complexity of TMs*
S-6	SLO-1	*Equivalence of NFA and DFA*	*Problems related to Simplification of CFG*	*Problems related to Equivalence of PDA to CFG*	*Techniques for Turing Machine Construction*	*Complexity classes: Class P, Class NP*
	SLO-2	*Heuristics to Convert NFA to DFA*				
S-7	SLO-1	*Equivalence of NDFA's with and without €-moves*	*Chomsky normal form*	*CFL to Pushdown automata Equivalence*	*Considering the state as a tuple Considering the tape symbol as a tuple*	*Complexity classes: Introduction to NP-Hardness*
	SLO-2	*Problems related Equivalence of NDFA's with and without €-moves*	*Problems related to CNF*	*Problems related to Equivalence of CFG to PDA*	*Checking off symbols*	*NP Completeness*
S-8	SLO-1	*Minimization of DFA*	*Greiback Normal form*	*Pumping lemma for CFL*	*Modifications of Turing Machine*	
	SLO-2	*Problems related to Minimization of DFA*			*Multi-tape Turing Machine*	

S-9	SLO-1	*Regular Languages : Equivalence of Finite Automata and Regular Languages*	*Problems related to GNF*	*Problems based on pumping Lemma*	*Non-Deterministic Turing Machine*	
	SLO-2	*Equivalence of Finite Automata and Regular Grammars*			*Semi-Infinite Tape Turing Machine*	
S-10	SLO-1	*Problems related to Equivalence of Finite Automata and Regular Languages and Regular Grammars*				
	SLO-2	*Variants of Finite Automata :Two-way Finite Automaton Mealy Machines*				
S-11	SLO-1	*Properties of Regular Languages: Closure Properties*				
	SLO-2	*Set Theoretic Properties & Other Properties*				
	SLO-3	*Pumping Lemma*				

Learning Resources	1.Hopcroft J.E., Motwani R. and Ullman J.D, "Introduction to Automata Theory, Languages and Computations", Second Edition, Pearson Education, 2008. 2. Michael Sipser, "Introduction to the Theory of Computation" Cengage Learning, 2012.	*4*..John.C.Martin, "Introduction to Languages and the Theory of Computation" McGraw-Hill Education, 01- May-2010. 5. Kamala Krithivasan, Rama.R," Introduction to Formal Languages, Automata Theory and Computation", Pearson Education India, 01-Sep-2009. 6. Peter Linz , "An introduction to formal languages and automata", Jones & Bartlett Learning, 2001.

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	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	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.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		Dr.R.AnnieUthra
		Dr.Jeyasudha

Course Code	18CSC302J	Course Name	COMPUTER NETWORKS	Course Category	C	Professional Core	L	T	P	C
							3	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understand the evolution of computer networks using the layered network architecture
CLR-2 :	Understand the addressing concepts and learn networks devices
CLR-3 :	Design computer networks using subnetting and routing concepts
CLR-4 :	Understand the error types , framing, flow control
CLR-5 :	Understand the various Medium Access Control techniques and also the characteristics of physical layer functionalities
CLR-6 :	Understand basic network administration

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		LevelofThinking (Bloom)	ExpectedProficiency (%)	Expected Attainment(%)	EngineeringKnowledge	ProblemAnalysis	Design&Development	Analysis,Design, Research	ModernTool Usage	Society&Culture	Environment& Sustainability	Ethics	Individual & TeamWork	Communication	ProjectMgt.&Finance	LifeLongLearning	PSO-1	PSO-2	PSO-3
CLO-1 :	Acquire the basics of computer network and its architecture	3	80	70	L	H	-	H	L	-	-	-	L	L	-	H	-	-	-
CLO-2 :	Acquire the knowledge of various networks devices and addressing methods	3	85	75	M	H	L	M	L	-	-	-	M	L	-	H	-	-	-
CLO-3 :	Abilty to design the network routing methods	3	75	70	M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
CLO-4 :	Acquire the various error codes and framing concepts	3	85	80	M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
CLO-5 :	Ability to understand the physical layer functions and components	3	85	75	H	H	M	H	L	-	-	-	M	L	-	H	-	-	-
CLO-6 :	Ability to design a computer network using a switch and router	3	80	70	L	H	-	H	L	-	-	-	L	L	-	H	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Evolution of Computer Networks	*Addressing types*	*Network layer functionalities*	*Introduction- error types*	*Physical layer overview*
	SLO-2	*The Internet today*	*Physical, logical, port, specific addresses*	*Delivery vs Forwarding*	*Detection vs Correction*	*Functionalities*
S-2	SLO-1	*Data communications*	*IPv4 addresses*	*Unicast routing protocols*	*Error detection*	*Analog and digital*
	SLO-2	*Components*	*Notations*	*Intra , inter domain routing*	*Parity*	*Data, signals*
S-3	SLO-1	*Networks*	*Classful addressing*	*Multicast routing protocols*	*CRC*	*Transmission impairment*
	SLO-2	*Physical structures*	*Categories*	*Applications*	*Checksum*	*Attenuation, Distortion, Noise*
S 4-5	SLO-1	*Lab 1: Introduction to Packet racer*	*Lab 4* :IP Addressing and subnetting (VLSM).	*Lab 7 :* Implementation of Static Routing	*Lab 10: Implementation of* EIGRP Configuration	*Lab 13: Implementation of* Single-Area OSPF Link Costs and Interface
	SLO-2					
S-6	SLO-1	*Network models*	*Classless addressing*	*Distance vector routing*	*Error correction*	*Performance metrics*
	SLO-2	*Categories of network*	*Prefix usage*	*Node instability issues*	*Hamming code*	*Bandwidth, delay, throughput, jitter*
S-7	SLO-1	*Protocols and standards*	*Network Address Translation(NAT)*	*RIPv1*	*Framing*	*Wireless 802.11*
	SLO-2	*Standards organizations*	*Translation table*	*RIPv2*	*Flow control*	*Addressing mechanism*

S-8	SLO-1	*Layered tasks*	*IPv6 addresses*	*Link state routing*	*Error control*	Transmission Media
	SLO-2	*Hierarchy*	*Types, Notation*	*Dijkstra's Algorithm*	*ARQ types*	Twisted pair, Coaxial, Fibre
S 9-10	SLO-1 SLO-2	*Lab 2: Implementation of various Topology creation*	*Lab 5:* Configuring Interfaces	*Lab 8: Implementation of* Default Routing	*Lab 11: Implementation of EIGRP* Bandwidth and Adjacencies	*Lab 14 :Implementation of* Multi-Area OSPF with Stub Areas and Authentication
S-11	SLO-1	*OSI model*	*VLSM*	*OSPF*	*Random access*	IEEE 802.15
	SLO-2	*Layered approach, Peer-peer approach*	*Masking*	*EIGRP*	*ALOHA*	*Architecture*
S-12	SLO-1	*Layers in the OSI model*	*CIDR*	*Path vector routing*	*CSMA/CD*	IEEE 802.15.4
	SLO-2	*Comparison of layers*	*Address aggregation*	*Stabilized routing table creation for AS*	*CSMA/CA*	*Architecture*
S-13	SLO-1	*TCP/IP protocol suite*	*Networking devices*	*BGP*	*Controlled access*	IEEE 802.16
	SLO-2	*Comparison with OSI moldel*	*Router, Switch, hub, Bridges*	*BGP Sessions*	*Channelization*	*Architecture*
S 14-15	SLO-1 SLO-2	*Lab 3: Implement the categories of network(LAN,MAN,WAN)*	*Lab 6:* Basic Router Configuration, Creating Passwords	*Lab 9: Implementation of RIPv1, v2*	*Lab 12:Implementation of* EIGRP Authentication and Timers	*Lab 15 :* Redistribution Between EIGRP and OSPF

Learning Resources	1. BehrouzA.Forouzan,"DataCommunicationsandNetworking"5th edition,July1,2010,ISBN: 9780073376226. 2. ToddLammle,"CCNAStudyGuide",Edition7,2011, ISBN:13:9780470901076. 3. WilliamStallings,"DataandComputerCommunications",Edition9,2010.	

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 Understand	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
Level 2	Apply Analyze	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
Level 3	Evaluate Create	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Total	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.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.. Dr. Sricharan, Wipro Technologies, Chennai	*1. Dr.Noor Mahammad, IIITDM, Kancheepuram, noor@iiitdm.ac.in*	*1. Mr. K. Venkatesh, SRMIST*
2.	*2.*	*2.Ms.D. Anitha, SRMIST*
	3.	*3. Ms. Ferni Ukrit, SRMIST*

Course Code	18CSE388T	Course Name	ARTIFICIAL NEURAL NETWORKS	Course Category	E	Professional Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
CLR-1 :	Connect Biology with Computers			
CLR-2 :	Understand components of artificial neural networks			
CLR-3 :	Understand supervised learning networkparadigms			
CLR-4 :	Understand unsupervised learning networkparadigms			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Know the purpose of Artificial Neural Networks	1	80	85
CLO-2 :	Apply the concepts of activation, propogation functions	2	75	80
CLO-3 :	Work with supervised learning network paradigm	3	85	80
CLO-4 :	Work with unsupervised learning network paradigm	3	80	75

Program Learning Outcomes (PLO)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	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	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	H	L	-	-	H-	-	-	-	-	-	-	H	L	L	-
CLO-2 :	H	H	-	-	H	-	-	-	-	-	-	H	H	H	H
CLO-3 :	H	H	H	-	H	-	-	-	-	-	-	H	H	H	H
CLO-4 :	H	H	-	-	H	-	-	-	-	-	-	H	H	H	H

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Why neural network?	Components of artificial neural networks	Learning and training samples	Radial basis functions	Unsupervised learning networkparadigms
	SLO-2	Basics of Artificial Neural Networks	The concept of time in neural networks	Paradigms of Learning	Information processing of an RBF network	Structure of a self-organizing map(SOM)
S-2	SLO-1	A brief history of neural networks Biological neural networks	Connections	Using training samples	Training of RBF networks	Functionality
	SLO-2		Propagation function	Gradient Optimization Procedure	Growing of RBF networks	Training
S-3	SLO-1	Biological neural networks	Activation	Hebbian learning rule		Topology function
	SLO-2	The vertebrate nervous system	Threshold value, Activation function	Supervised learning networkparadigms	Compare multilayer perceptrons and RBF	Decreasing Learning Rate
S-4	SLO-1	peripheral nervous system	Common activation functions	The perceptron, back propagation and its variants	Recurrent perceptron-like networks	Variations of SOMs
	SLO-2	Cerebrum, cerebellum,	Output function, Learning strategies	Singlelayer perceptron	Jordan networks	Neural gas
S-5	SLO-1	diencephalon,brainstem	Network topologies	Linear Separability	Elman networks	Multi-SOM
	SLO-2	The Neuron	Feedforward networks	Multilayer perceptron	Training recurrent networks	Multi-neural gas
S-6	SLO-1	Components	Recurrentnetworks	Backpropagation of error		Growing neural gas
	SLO-2	Electrochemical processes	Completely linked networks	Selecting learning rate	Unfolding in time	Adaptive resonance theory(ART)
S-7	SLO-1	Receptor cells- Various types	Bias neuron	Resilient Backpropagation	Teacher forcing	Task and structure of an ART network
	SLO-2	Information processing within nervous system	Representing Neurons	Adaption of Weights	Recurrent backpropagation	Resonance
S-8	SLO-1	Light Sensing organs	Orders of Activation	Variations in Backpropagation		
	SLO-2	Neurons in living organisms	Synchronous activation			
S-9	SLO-1	Transition to technical neurons	Asynchronous activation	Multilayer perceptron	Evolutionary algorithms	Learning process of an ART network
	SLO-2		input and outputof data			

Learning Resources	*1. David Kriesel, A BriefIntroduction to Neural Networks, dkriesel.com, 2005* *2. GunjanGoswami, Introduction to Artificial Neural Networks, S.K. Kataria& Sons, 2012*	*3. Raul Rojas, Neural Networks: A Systematic Introduction, 1996.* *4. S. Sivanandam, Introduction to Artificial Neural Networks, 2003*

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	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	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.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. 1. Dr.Harisekharan,CTO,Sri SeshaaTechnologies Pvt. Ltd., Chennai	1. Dr.J.Suresh, SSN College of Engineering	Dr.G.Vadivu
	2. Dr. Sharmila Shankar, Crescent Institute of Science and Technology	Dr. D.Rajeswari
		Dr.M.S.Abirami

Course Code	18CSE390T	Course Name	COMPUTER VISION	Course Category	E	Professional Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
		LevelofThinking (Bloom)	ExpectedProficiency (%)	ExpectedAttainment(%)
CLR-1 :	Recognize and describe both the theoretical and practical aspects of computing with images. Connect issues from Computer Vision to Human Vision			
CLR-2 :	Describe the foundation of image formation and image analysis. Understand the basics of 2D and 3D Computer Vision.			
CLR-3 :	Become familiar with the major technical approaches involved in computer vision. Describe various methods used for registration, alignment, and matching in images.			
CLR-4 :	Get an exposure to advanced concepts leading to object and scene categorization from images.			
CLR-5 :	Build computer vision applications.			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		LevelofThinking (Bloom)	ExpectedProficiency (%)	ExpectedAttainment(%)	EngineeringKnowledge	ProblemAnalysis	Design&Development	Analysis,Design,Research	ModernTool Usage	Society&Culture	Environment& Sustainability	Ethics	Individual & TeamWork	Communication	ProjectMgt.&Finance	LifeLongLearning	PSO-1	PSO-2	PSO–3
CLO-1 :	Provide an introduction to computer vision including fundamentals of image formation	3	80	75	L	H	-	H	L	-	-	-	L	L	-	H	-	-	-
CLO-2 :	Provide a clear view of image formation	3	85	75	M	H	L	H	L	-	-	-	M	L	-	H	-	-	-
CLO-3 :	Provide a clear view of image processing	3	80	75	M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
CLO-4 :	Provide knowledge about Computational photography	3	85	80	M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
CLO-5 :	Provide knowledge about Image rendering	3	80	75	H	H	M	H	L	-	-	-	M	L	-	H	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Introduction to Computer Vision	Points and patches-An Introduction	Active contours	Triangulation	Motion models
	SLO-2	Image formation	Feature detectors	Snakes	Two-frame structure from motion	Planar perspective motion
S-2	SLO-1	Geometric primitives	Feature descriptors	Dynamic snakes and CONDENSATION	Projective reconstruction	Rotational panoramas
	SLO-2	2D,3D Transformations			Self-calibration	
S-3	SLO-1	3D to 2D Projection	Feature matching	Scissors	Perspective and projective factorization	Gap closing
	SLO-2	Lighting,Reflectance and shading		Level Sets	Bundle adjustment	
S-4	SLO-1	Sampling and aliasing	Feature tracking	Split and merge	Exploiting sparsity	Cylindrical and spherical coordinates
	SLO-2	Image processing Point operators				
S-5	SLO-1	Pixel transforms	Edge detection	Mean shift and mode finding	Constrained structure and motion	Bundle adjustment
	SLO-2	Color transforms				
S-6	SLO-1	Histogram equalization	Edge linking	Normalized cuts	Hierarchical motion estimation	Parallax removal
	SLO-2					
S-7	SLO-1	Linear filtering	Successive approximation	Graph cuts and energy-based methods	Fourier-based alignment	Recognizing panoramas

	SLO-2	*Non Linear filtering*	*Hough transforms*			
S-8	SLO-1	*Fourier transforms*	*Hough transforms*	*2D and 3D feature-based alignment*	*Incremental refinement*	*Compositing*
S-9	SLO-1	*Two-dimensional Fourier transforms , Wiener filtering*	*Vanishing points*	*Pose estimation*	*Case Study*	*Case Study*

Learning Resources	1. *RichardSzeliski,"ComputerVision:AlgorithmsandApplications",Springer,2010.* 2. *Forsyth/Ponce,"ComputerVision:AModernApproach",PearsonEducationIndia;2edition(2015)* 3. *S.Nagabhushana,"ComputerVisionandImageProcessing",NewAgeInternationalPvtLtd;First edition(2005)*	*4. Rafael C. GonzaLez'"Digital Image Processing",Pearson Education; Fourth edition (2018)*

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%)#	
Level 1	Remember	40%	30%	30 %	30%	*30%*
	Understand					
Level 2	Apply	*40%*	40%	40 %	40%	*40%*
	Analyze					
Level 3	Evaluate	*10%*	*30%*	*30%*	*30%*	*30%*
	Create					
	Total	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.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
	Dr. A.P.Shanthi , CEG Campus Anna University	*1.Dr.V.Ganapathy,SRMIST*
		2.T.Senthil Kumar,SRMIST

Course Code	18ECO133T	Course Name	SENSORS AND TRANSDUCERS	Course Category	O	Open Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Electronics and Instrumentation Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	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	PSO 1: Automatic control for continuous& discrete	PSO-2: Utilize PLC & DCS for control of	PSO-3: Effective management skills
CLR-1 :	Gain knowledge on classification, and characteristics of transducers																		
CLR-2 :	Acquire the knowledge of different types of inductive and capacitive sensors																		
CLR-3 :	Acquire the knowledge of different types of thermal and radiation sensors																		
CLR-4 :	Acquire the knowledge of different types of magnetic sensors																		
CLR-5 :	Acquire the knowledgeof different types of sensors measuring non-Electrical quantity																		
CLR-6 :	Locate the Applications of sensors in industries and home appliances																		
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*																		
CLO-1 :	To demonstrate the various types of basic sensors.	2,3	80	80	H	-	H	-	-	H	H	H	-	-	-	H	H	-	-
CLO-2 :	Understand the inductive and capacitive sensors which are used for measuring various parameters.	1,2	80	80	H	-	-	H	-	H	-	-	-	-	-	H	-	H	-
CLO-3 :	Understand the thermal and radiation sensors	1	80	80	-	-	-	-	-	H	-	-	H	H	-	-	H	-	-
CLO-4 :	Have an adequate knowledge on the various magnetic sensors	3	80	80	-	H	H	-	-	-	-	-	-	-	-	-	-	H	-
CLO-5 :	To demonstrate the various types of basic sensors measuring non electrical quantity	3	80	80	-	-	H	-	H	-	-	-	-	-	-	H	-	-	H
CLO-6 :	Select the right transducer for the given application	3	80	80	H	-	H	-	-	H	H	H	-	-	-	H	H	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Introduction to sensors/ transducers, Principles	Introduction to Inductive sensor	Thermal sensors: Introduction	Magnetic sensors: Introduction	Measurement of Non-Electrical quantity: Introduction
	SLO-2	Classification based on different criteria	Sensitivity and linearity of the sensor	Thermal Expansion type.	Villari effect	Flow Measurement – Introduction.
S-2	SLO-1	Characteristics of measurement systems	Transformer type transducer	Acoustics temperature sensors.	Wiedmann effect	Ultrasonic Flow Meters.
	SLO-2	Static characteristics Accuracy, Precision, Resolution, Sensitivity	Electromagnetic transducer	Thermo-emf sensor.	Hall effect	Hot Wire Anemometers.
S-3	SLO-1	Dynamic characteristics.	Magnetosrtictive transducer	Materials for thermos-emf sensors.	Construction,	Electromagnetic Flow meters.
	SLO-2	Environmental Parameters	Materials used in inductive sensor	Thermocouple construction	performance characteristics,	Principle and types.
S-4	SLO-1	Characterization and its type	Mutual Inductance change type	Types.	and its Application	Measurement of Displacement.
	SLO-2	Electrical characterization.	LVDT: Construction.	Thermo-sensors using semiconductor device	Introduction to smart sensors	Introduction and types.
S-5	SLO-1	Mechanical Characterization.	Material, input output relationship,	Pyroelectric thermal sensors	Film sensors: Introduction	Measurement of Velocity/ Speed.
	SLO-2	Thermal Characterization	Synchros-Construction	Introduction	Thick film sensors	Introduction and types.

S-6	**SLO-1**	*Optical Characterization.*	*Capacitive sensor: Introduction*	*characteristics*	*Microelectromechanical systems*	*Measurement of Liquid Level.*
	SLO-2	*Errors and its classification.*	*Parallel plate capacitive sensor*	*Application*	*Micromachining.*	*Introduction and types.*
S-7	**SLO-1**	*Selection of transducers.*	*Variable thickness dielectric capacitive sensor*	*Radiation sensors.*	*Nano sensors*	*Measurement of Pressure.*
	SLO-2	*Introduction to mechanical sensors*	*Electrostatic transducer*	*Introduction*	*Applications: Industrial weighing systems: Link–lever mechanism.*	*Introduction and types.*
S-8	**SLO-1**	*Resistive potentiometer and types*	*Piezoelectric elements*	*Characteristics*	*Load cells – pneumatic, elastic and their mounting.*	*Measurement of Vibration.*
	SLO-2	*Strain gauge: Theory, type, design consideration, sensitivity.*	*Ultrasonic Sensors*	*Geiger counters*	*different designs of weighing systems.*	*Introduction and types.*
S-9	**SLO-1**	*Resistive transducer: RTD, materials used in RTD*	*Calculation of sensitivity.*	*Scintillation detectors*	*conveyors type.*	*Application of sensors in industries*
	SLO-2	*Thermistor: thermistor material, shape*	*Capacitor microphone, response characteristics*	*Application on radiation sensors*	*weighfeeder type.*	*Application of sensors in home appliances*

Learning Resources	1. *Patranabis, D., "Sensors and Transducers", 2nd Edition, Prentice Hall India Pvt. Ltd, 2010.* 2. *Doeblin, E.O., "Measurement Systems: Applications and Design", 6thEdition, Tata McGraw-Hill Book Co., 2011.* 3. *Bentley, J. P., "Principles of Measurement Systems", 4th Edition, Addison Wesley Longman Ltd., UK, 2004.*	4. *Murthy, D.V.S., "Transducers and Instrumentation", Prentice Hall of India Pvt. Ltd., New Delhi, 2010.* 5. *Neubert H.K.P., "Instrument Transducers – An Introduction to their performance and Design", Oxford University Press, Cambridge, 2003.*

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 / Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply / Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate / Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	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.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. D. Karthikeyan, Controlsoft Engineering India Pvt Ltd, karthikeyan.d@controlsoftengg.in	*1. Dr. J. Prakash, MIT, Chennai, prakaiit@rediffmail.com*	*Mrs. K. Vibha, SRMIST*
2. V. Venkateswaran, Instrumentation Consultant, vvenkat99@gmail.com	*2. Dr. D. Nedumaran, Madras University, dnmaran@gmail.com*	*Dr. G. Joselin Retna Kumar, SRMIST*