ACADEMIC CURRICULA

UNDERGRADUATE DEGREE PROGRAMMES

Bachelor of Technology

(B.Tech. - Four Years)

(Choice Based Flexible Credit System)

Regulations 2018

CURRICULUM
For
B.Tech Computer Science and Engineering

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Chengalpattu District 603203, Tamil Nadu, India

B.Tech. in Computer Science and Engineering

a) Mission of the Department

Mission Stmt - 1	*To impart knowledge in cutting edge Computer Science and Engineering technologies in par with industrial standards.*
Mission Stmt - 2	*To collaborate with renowned academic institutions to uplift innovative research and development in Computer Science and Engineering and its allied fields to serve the needs of society*
Mission Stmt - 3	*To demonstrate strong communication skills and possess the ability to design computing systems individually as well as part of a multidisciplinary teams.*
Mission Stmt - 4	*To instill societal , safety, cultural, environmental, and ethical responsibilities in all professional activities*
Mission Stmt - 5	*To produce successful Computer Science and Engineering graduates with personal and professional responsibilities and commitment to lifelong learning*

b) Program Educational Objectives (PEO)

PEO - 1	*Graduates will be able to perform in technical/managerial roles ranging from design, development, problem solving to production support in software industries and R&D sectors.*
PEO - 2	*Graduates will be able to successfully pursue higher education in reputed institutions.*
PEO - 3	*Graduates will have the ability to adapt, contribute and innovate new technologies and systems in the key domains of Computer Science and Engineering.*
PEO - 4	*Graduates will be ethically and socially responsible solution providers and entrepreneurs in Computer Science and other engineering disciplines.*
PEO - 5	*Graduates will possess the additional skills in core computer science discipline with knowledge of Hardware, Software , Programming , Logic & Reasoning.*

c) Mission of the Department to Program Educational Objectives (PEO) Mapping

	Mission Stmt. - 1	Mission Stmt. - 2	Mission Stmt. - 3	Mission Stmt. - 4	Mission Stmt. - 5
PEO - 1	*H*	*H*	*H*	*H*	*H*
PEO - 2	*L*	*H*	*H*	*H*	*H*
PEO - 3	*H*	*H*	*M*	*L*	*H*
PEO - 4	*M*	*H*	*M*	*H*	*H*
PEO - 5	*H*	*H*	*M*	*M*	*H*

H – High Correlation, M – Medium Correlation, L – Low Correlation

d) Mapping Program Educational Objectives (PEO) to Program Learning Outcomes (PLO)

	Program Learning Outcomes (PLO)														
	Graduate Attributes (GA)												Program Specific Outcomes (PSO)		
	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
PEO - 1	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*
PEO - 2	*H*	*H*	*H*	*H*	*H*	*L*	*L*	*H*	*L*	*H*	*L*	*H*	*H*	*H*	*H*
PEO - 3	*H*	*H*	*H*	*H*	*H*	*L*	*L*	*L*	*L*	*L*	*H*	*H*	*H*	*H*	*H*
PEO - 4	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*
PEO - 5	*H*	*H*	*H*	*H*	*H*	*M*	*M*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*

H – High Correlation, M – Medium Correlation, L – Low Correlation

PSO – Program Specific Outcomes (PSO)

PSO - 1	*Ability to understand client requirements and suggest solutions*
PSO - 2	*Ability to create Software for automation and function*
PSO - 3	*Ability to utilize Logic & Reasoning Skills*

e) Program Structure: B.Tech. in Computer Science and Engineering

1. Humanities & Social Sciences including Management Courses (H)						
Course Code	Course Title	Hours/ Week			C	
		L	T	P		
18LEH101J	English	2	0	2	3	
18LEH102J	Chinese					
18LEH103J	French					
18LEH104J	German	2	0	2	3	
18LEH105J	Japanese					
18LEH106J	Korean					
18PDH101T	General Aptitude	0	0	2	1	
18PDH102T	Management Principles for Engineers	2	0	0	2	
18PDH103T	Social Engineering	2	0	0	2	
18PDH201T	Employability Skills & Practices	0	0	2	1	
Total Learning Credits					12	

2. Basic Science Courses (B)						
Course Code	Course Title	Hours/ Week			C	
		L	T	P		
18PYB103J	Physics: Semiconductor Physics	3	1	2	5	
18CYB101J	Chemistry	3	1	2	5	
18MAB101T	Calculus and Linear Algebra	3	1	0	4	
18MAB102T	Advanced Calculus and Complex Analysis	3	1	0	4	
18MAB201T	Transforms and Boundary Value Problems	3	1	0	4	
18MAB204T	Probability and Queueing Theory	3	1	0	4	
18MAB302T	Discrete Mathematics for Engineers	3	1	0	4	
18BTB101T	Biology	2	0	0	2	
Total Learning Credits					32	

3. Engineering Science Courses (S)						
Course Code	Course Title	Hours/ Week			C	
		L	T	P		
18MES101L	Engineering Graphics and Design	1	0	4	3	
18EES101J	Basic Electrical and Electronics Engineering	3	1	2	5	
18MES103L	Civil and Mechanical Engineering Workshop	1	0	4	3	
18CSS101J	Programming for Problem Solving	3	0	4	5	
18CSS201J	Analog and Digital Electronics	3	0	2	4	
18CSS202J	Computer Communications	2	0	2	3	
Total Learning Credits					23	

4. Professional Core Courses (C)						
Course Code	Course Title	Hours/ Week			C	
		L	T	P		
18CSC201J	Data Structures and Algorithms	3	0	2	4	
18CSC202J	Object Oriented Design and Programming	3	0	2	4	
18CSC203J	Computer Organization and Architecture	3	0	2	4	
18CSC204J	Design and Analysis of Algorithms	3	0	2	4	
18CSC205J	Operating Systems	3	0	2	4	
18CSC206J	Software Engineering and Project Management	3	0	2	4	
18CSC207J	Advanced Programming Practice	3	0	2	4	
18CSC301T	Formal Language and Automata	3	0	0	3	
18CSC302J	Computer Networks	3	0	2	4	
18CSC303J	Database Management Systems	3	0	2	4	
18CSC304J	Compiler Design	3	0	2	4	
18CSC305J	Artificial Intelligence	3	0	2	4	
18CSC350T	Comprehension	0	1	0	1	
18CSC208L	Competitive Professional Skills-I	0	0	2	1	
18CSC306L	Competitive Professional Skills-II	0	0	2	1	
18CSC307L	Competitive Professional Skills-III	0	0	2	1	
Total Learning Credits					51	

5. Professional Elective Courses (E) (Any 6 Elective Courses)						
Course Code	Course Title	Hours/ Week			C	
		L	T	P		
18CSE351T	Computational Logic	3	0	0	3	
18CSE352T	Neuro Fuzzy and Genetic Programming	3	0	0	3	
18CSE353T	Digital Image Processing	3	0	0	3	
18CSE354T	Network Security	3	0	0	3	
18CSE355T	Data Mining and Analytics	3	0	0	3	
18CSE356T	Distributed Operating Systems	3	0	0	3	
18CSE357T	Biometrics	3	0	0	3	
18CSE358T	Pattern Recognition Techniques	3	0	0	3	
18CSE359T	Natural Language Processing	3	0	0	3	
18CSE360T	Information Storage and Management	3	0	0	3	
18CSE451T	Wireless Sensor Networks	3	0	0	3	
18CSE452T	Network Protocols and Programming	3	0	0	3	
18CSE453T	Network Routing Algorithms	3	0	0	3	
18CSE454T	High Performance Computing	3	0	0	3	
18CSE455T	Database Security and Privacy	3	0	0	3	
18CSE456T	Software Defined Networks	3	0	0	3	
18CSE457T	Semantic Web	3	0	0	3	
18CSE458T	Wireless and Mobile Communication	3	0	0	3	
18CSE459T	Service Oriented Architecture	3	0	0	3	
18CSE460T	Network Design and Management	3	0	0	3	
Total Learning Credits					18	

6. Open Elective Courses (O)						
Course Code	Course Title	Hours/ Week			C	
		L	T	P		
18CSO101T	IT Infrastructure Management	3	0	0	3	
18CSO102T	Mobile Application Development	3	0	0	3	
18CSO103T	System Modeling and Simulation	3	0	0	3	
18CSO104T	Free and Open Source Softwares	3	0	0	3	
18CSO105T	Android Development	3	0	0	3	
18CSO106T	Data Analysis using Open Source Tool	3	0	0	3	
18CSO107T	IOS Development	3	0	0	3	
Total Learning Credits					9	

8. Mandatory Courses (M)						
Code	Course Title	L	T	P	C	
18PDM101L	Professional Skills and Practices	0	0	2	0	
18PDM201L	Competencies in Social Skills	0	0	2	0	
18PDM203L	Entrepreneurial Skill Development					
18PDM202L	Critical and Creative Thinking Skills	0	0	2	0	
18PDM204L	Business Basics for Entrepreneurs					
18PDM301L	Analytical and Logical Thinking Skills	0	0	2	0	
18PDM302L	Entrepreneurship Management					
18LEM101T	Constitution of India	1	0	0	0	
18LEM102J	Value Education	1	0	1	0	
18GNM101L	Physical and Mental Health using Yoga	0	0	2	0	
18LEM109T	Indian Traditional Knowledge	1	0	0	0	
18LEM110L	Indian Art Form	0	0	2	0	

7. Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P)						
Course Code	Course Title	Hours/ Week			C	
		L	T	P		
18CSP101L	Massive Open Online Course - I	0	0	2	1	
18CSP102L	Industrial Training-I					
18CSP103L	Seminar - I					
18CSP104L	Massive Open Online Course - II	0	0	2	1	
18CSP105L	Industrial Training-II					
18CSP106L	Seminar - II					
18CSP107L	Minor Project	0	0	6	3	
18CSP108L	Internship (4-6 weeks)					
18CSP109L	Project	0	0	20	10	
18CSP110L	Semester Internship					
Total Learning Credits					15	

8. Mandatory Courses (M)						
Course Code	Course Title	Hours/ Week			C	
		L	T	P		
18GNM102L	NSS	0	0	2	0	
18GNM103L	NCC					
18GNM104L	NSO					
18CYM101T	Environmental Science	1	0	0	0	

f) Program Articulation: B.Tech. in Computer Science and Engineering

Course Code	Course Name	Program Learning Outcomes (PLO)													
		Graduate Attributes											PSO		
		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
18CSS101J	Programming for Problem Solving	3	3	3	-	-	-	-	-	-	-	-	-	-	-	3
18CSC201J	Data Structures and Algorithms	3	3	3	-	-	-	-	-	-	-	-	3	-	-	3
18CSC202J	Object Oriented Design and Programming	3	3	2	-	-	-	-	-	2	2	-	-	3	2	2
18CSC203J	Computer Organization and Architecture	3	3	-	-	-	-	-	-	-	-	-	2	-	-	-
18CSC204J	Design and Analysis of Algorithms	2	3	3	-	-	-	-	-	-	-	-	-	-	-	3
18CSC205J	Operating Systems	3	2	2	-	-	-	-	-	-	-	-	-	2	2	-
18CSC206J	Software Engineering and Project Management	3	2	3	-	-	-	-	-	-	-	-	3	-	-	2
18CSC207J	Advanced Programming Practice	3	3	3	-	-	-	-	-	-	-	-	3	-	-	3
18CSC301T	Formal Language and Automata	3	3	3	-	-	-	-	-	-	-	-	-	-	-	3
18CSC302J	Computer Networks	3		1	1	3	-	-	-	-	-	-	-	-	-	2
18CSC303J	Database Management Systems	3	3	3	-	-	-	-	-	-	-	-	-	2	2	-
18CSC304J	Compiler Design	3	3	3	-	-	-	-	-	-	-	-	-	-	-	3
18CSC305J	Artificial Intelligence	3	3	3	-	-	-	-	-	-	-	-	-	2	2	3
18CSE351T	Computational Logic	3	3	3	-	-	-	-	-	-	-	-	-	-	-	3
18CSE352T	Neuro Fuzzy and Genetic Programming	3	2	2	-	-	-	-	-	-	-	-	3	-	-	-
18CSE353T	Digital Image Processing	2	2	-	3	-	-	-	-	-	-	-	-	-	-	2
18CSE354T	Network Security	3	-	-	-	-	-	-	-	-	-	-	-	-	-	1
18CSE355T	Data Mining and Analytics	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-
18CSE356T	Distributed Operating Systems	3	3	-	3	-	-	-	-	-	-	-	-	-	2	-
18CSE357T	Biometrics	3	-	3		-	-	-	-	2-	-	-	-	-	-	2
18CSE358T	Pattern Recognition Techniques	3	3	3	-	-	-	-	-	-	-	-	-	-	1	-
18CSE359T	Natural Language Processing	3	2	2	3	-	-	-	-	-	-	-	-	-	-	-
18CSE360T	Information Storage and Management	3	3	3	3	-	-	-	-	2	-	3	-	-	-	-
18CSE451T	Wireless Sensor Networks	3	1	2	-	-	-	-	-	-	-	-	-	-	-	-
18CSE452T	Network Protocols and Programming	3	3	-	3	-	-	-	-	-	-	-	-	-	-	-
18CSE453T	Network Routing Algorithms	2	3	2	-	2	-	-	-	-	-	-	-	-	-	-
18CSE454T	High Performance Computing	3	3	-	-	3	-	-	-	3	-	-	3		-	-
18CSE455T	Database Security and Privacy	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
18CSE456T	Software Defined Networks	3	-	3	2	-	-	-	-	-	-	-	-	-	2	-
18CSE457T	Semantic Web	3	2	3	3	-	-	-	-	-	-	-	-	-	-	2
18CSE458T	Wireless and Mobile Communication	3	2	-	-	-	-	-	-	-	-	-	-	-	-	2
18CSE459T	Service Oriented Architecture	3	3	-	-	2	-	-	-	-	-	-	-	3	-	-
18CSE460T	Network Design and Management	2	-	-	-	3	-	-	-	-	-	-	-	-	-	-
18CSP107L	Minor Project	3	2	2	3	3	3	1	3	3	3	3	3	-	-	-
18CSP109L	Project	3	2	2	3	3	3	1	3	3	3	3	3	-	-	-
	Program Average	3	3	3	3	2	-	-	-	2	2	3	3	3	3	3

H – High Correlation, M – Medium Correlation, L – Low Correlation

g) Implementation Plan: B.Tech. in Computer Science and Engineering

Semester - I

Code	Course Title	Hours/ Week L	T	P	C
18LEH101J	English	2	0	2	3
18MAB101T	Calculus and Linear Algebra	3	1	0	4
18PYB103J	Physics: Semiconductor Physics	3	1	2	5
18MES101L	Engineering Graphics and Design	1	0	4	3
18EES101J	Basic Electrical and Electronics Engineering	3	1	2	5
18PDM101L	Professional Skills and Practices	0	0	2	0
18LEM101T	Constitution of India	1	0	0	0
18GNM101L	Physical and Mental Health using Yoga	0	0	2	0
	Total Learning Credits				20

Semester - II

Code	Course Title	Hours/ Week L	T	P	C
18LEH10XJ	Chinese / French / German / Japanese/ Korean	2	0	2	3
18MAB102T	Advanced Calculus and Complex Analysis	3	1	0	4
18CYB101J	Chemistry	3	1	2	5
18CSS101J	Programming for Problem Solving	3	0	4	5
18MES103L	Civil and Mechanical Engineering Workshop	1	0	4	3
18PDH101T	General Aptitude	0	0	2	1
18LEM102J	Value Education	1	0	1	0
18GNM102L	NSS	0	0	2	0
18GNM103L	NCC				
18GNM104L	NSO				
	Total Learning Credits				21

Semester - III

Code	Course Title	Hours/ Week L	T	P	C
18MAB201T	Transforms and Boundary Value Problems	3	1	0	4
18BTB101T	Biology	2	0	0	2
18CSS201J	Analog and Digital Electronics	3	0	2	4
18CSC201J	Data Structures and Algorithms	3	0	2	4
18CSC202J	Object Oriented Design and Programming	3	0	2	4
18CSC203J	Computer Organization and Architecture	3	0	2	4
18PDH102T	Management Principles for Engineers	2	0	0	2
18PDM201L	Competencies in Social Skills	0	0	2	0
18PDM203L	Entrepreneurial Skill Development				
	Total Learning Credits				24

Semester - IV

Code	Course Title	Hours/ Week L	T	P	C
18MAB204T	Probability and Queueing Theory	3	1	0	4
18CSS202J	Computer Communications	2	0	2	3
18CSC204J	Design and Analysis of Algorithms	3	0	2	4
18CSC205J	Operating Systems	3	0	2	4
18CSC206J	Software Engineering and Project Management	3	0	2	4
18CSC207J	Advanced Programming Practice	3	0	2	4
18CSC208L	Competitive Professional Skills-I	0	0	2	1
18PDH103T	Social Engineering	2	0	0	2
18PDM202L	Critical and Creative Thinking Skills	0	0	2	0
18PDM204L	Business Basics for Entrepreneurs				
18CYM101T	Environmental Science	1	0	0	0
	Total Learning Credits				26

Semester - V

Code	Course Title	Hours/ Week L	T	P	C
18MAB302T	Discrete Mathematics for Engineers	3	1	0	4
18CSC301T	Formal Language and Automata	3	0	0	3
18CSC302J	Computer Networks	3	0	2	4
18CSC306L	Competitive Professional Skills-II	0	0	2	1
	Professional Elective – 1	3	0	0	3
	Professional Elective – 2	3	0	0	3
	Open Elective – 1	3	0	0	3
18CSP101L	Massive Open Online Course - I	0	0	2	1
18CSP102L	Industrial Training-I	0	0	2	1
18CSP103L	Seminar - I	0	0	2	0
18PDM301L	Analytical and Logical Thinking Skills				
18PDM302L	Entrepreneurship Management	0	0	2	0
18LEM109T	Indian Traditional Knowledge	1	0	0	0
	Total Learning Credits				22

Semester - VI

Code	Course Title	Hours/ Week L	T	P	C
18CSC303J	Database Management Systems	3	0	2	4
18CSC304J	Compiler Design	3	0	2	4
18CSC305J	Artificial Intelligence	3	0	2	4
18CSC350T	Comprehension	0	1	0	1
18CSC207L	Competitive Professional Skills-III	0	0	2	1
	Professional Elective – 3	3	0	0	3
	Professional Elective – 4	3	0	0	3
	Open Elective – 2	3	0	0	3
18CSP104L	Massive Open Online Course - II	0	0	2	1
18CSP105L	Industrial Training-II				
18CSP106L	Seminar - II				
18PDH201T	Employability Skills and Practices	0	0	2	1
18LEM110L	Indian Art Form	0	0	2	0
	Total Learning Credits				25

Semester - VII

Code	Course Title	Hours/ Week L	T	P	C
	Professional Elective – 5	3	0	0	3
	Professional Elective – 6	3	0	0	3
	Open Elective – 3	3	0	0	3
18CSP107L	Minor Project	0	0	6	3
18CSP108L	Internship (4-6 weeks)				
	Total Learning Credits				12

Semester - VIII

Code	Course Title	Hours/ Week L	T	P	C
18CSP109L	Project	0	0	20	10
18CSP110L	Semester Internship				
	Total Learning Credits				10

Course Code	18CSS101J	Course Name	PROGRAMMING FOR PROBLEM SOLVING	Course Category	S	*Engineering Sciences*	L	T	P	C
							3	0	4	5

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 Outcomes (PO)**

		Level of Thinking	Expected Proficiency	Expected Attainment
CLR-1 :	*Think and evolve logically to construct an algorithm into a flowchart and a pseudocode that can be programmed*	1	2	3
CLR-2 :	*Utilize the operators and looping constructs to solve problems in engineering and real-time*			
CLR-3 :	*Store and retrieve data in a single and multidimensional array*			
CLR-4 :	*Utilize custom designed functions that can be used to perform tasks and can be repeatedly used in any application*			
CLR-5 :	*Create storage constructs using structure and unions. Create and Utilize the dynamic memory allocation*			
CLR-6 :	*Create a logical mindset to solve various engineering applications using programming constructs in C*			

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Level of Thinking	Expected Proficiency	Expected Attainment	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design,	Modern Tool Usage	Society & Culture	Environment &	Ethics	Individual & Team	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO-1 :	*Design solutions for solving problems using tools like flowchart, algorithms and pseudo code*	5	60	70	2	3	-	-	-	-	-	-	-	-	-	-	-	-	3
CO-2 :	*Demonstrate ability to use appropriate C language constructs for solving a problem.*	5	60	70	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
CO-3 :	*Solve problems using number and character arrays with multiple dimensions.*	5	60	70	3	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO-4 :	*Create solution using modular mechanism utilizing pointer concepts*	5	60	70	3	2	3	3	-	-	-	-	-	-	-	-	-	-	3
CO-5 :	*Demonstrate ability to solve problem with effective utilizations of computer memory*	6	60	70	3	3	3	-	-	-	-	-	-	-	-	2	-	-	3
CO-6 :	*Apply file programming concepts to solve problems.*	6	60	70	2	2	-	-	-	-	-	-	-	-	-	2	-	-	3

Duration (hour)		21	21	21	21	21
S-1	SLO-1	*Evolution of Programming& Languages*	*Relational and logical Operators*	*Initializing and Accessing 2D Array*	*Passing Array Element to Function*	*Initializing Structure, Declaring structure variable*
	SLO-2	*Problem solving through programming*	*Condition Operators, Operator Precedence*	*Initializing Multidimensional Array*	*Formal and Actual Parameters*	*Structure using typedef, Accessing members*
S-2	SLO-1	*Creating algorithms*	*Expressions with pre / post increment operator*	*Array Programs – 2D*	*Advantages of using Functions*	*Nested structure Accessing elements in a structure array*
	SLO-2	*Drawing flowcharts*	*Expression with conditional and assignment operators*	*Array Contiguous Memory*	*Processor Directives and #define Directives*	*Array of structure Accessing elements in a structure array*
S-3	SLO-1	*Writing pseudocode*	*If statement in expression*	*Array Advantages and Limitations*	*Nested Preprocessor Macro*	*Passing Array of structure to function*
	SLO-2	*Evolution of C language, its usage history*	*L value and R value in expression*	*Array construction for real-time application Common Programming errors*	*Advantages of using Functions*	*Array of pointers to structures*
S 4-7	SLO-1 SLO-2	*Lab 1: Algorithm, Flow Chart, Pseudocode*	*Lab 4: Operators and Expressions*	*Lab 7: Arrays - Multidimensional*	*Lab 10: Functions*	*Lab 13: Structures & Unions*
S-8	SLO-1	*Input and output functions: Printf and scanf*	*Control Statements – if and else*	*String Basics*	*Pointers and address operator*	*Bit Manipulation to structure and Pointer to structure*
	SLO-2	*Variables and identifiers*	*else if and nested if, switch case*	*String Declaration and Initialization*	*Size of Pointer Variable and Pointer Operator*	*Union Basic and declaration*

S-9	SLO-1	*Expressions*	*Iterations, Conditional and Unconditional branching*	*String Functions: gets(), puts(), getchar(), putchar(), printf()*	*Pointer Declaration and dereferencing pointers*	*Accessing Union Members Pointers to Union*
	SLO-2	*Single line and multiline comments*	*For loop*	*String Functions: atoi, strlen, strcat, strcmp*	*Void Pointers and size of Void Pointers*	*Dynamic memory allocation, mallaoc, realloc, free*
S-10	SLO-1	*Constants, Keywords*	*While loop*	*String Functions: sprint, sscanf, strrev, strcpy, strstr, strtok*	*Arithmetic Operations*	*Allocating Dynamic Array*
	SLO-2	*Values, Names, Scope, Binding, Storage Classes*	*do while, goto, break, continue*	*Arithmetic Characters on Strings*	*Incrementing Pointers*	*Multidimensional array using dynamic memory allocation.*
S 11-14	SLO-1 SLO-2	*Lab 2: Input and Output Statements*	*Lab 5: Control Statements*	*Lab 8: Strings*	*Lab 11: Pointers*	*Lab 14: Structures & Unions*
S-15	SLO-1	*Numeric Data types: integer*	*Array Basic and Types*	*Functions declaration and definition*	*Constant Pointers*	*file: opening, defining, closing, File Modes, File Types*
	SLO-2	*Numeric Data types: floating point*	*Array Initialization and Declaration*	*Types: Call by Value, Call by Reference*	*Pointers to array elements and strings*	*Writing contents into a file*
S-16	SLO-1	*Non-Numeric Data types: char and string*	*Initialization: one Dimensional Array*	*Function with and without Arguments and no Return Values*	*Function Pointers*	*Reading file contents*
	SLO-2	*Increment and decrement operator*	*Accessing, Indexing one Dimensional Array Operations*	*Function with and without Arguments and Return Values*	*Array of Function Pointers*	*Appending an existing file*
S-17	SLO-1	*Comma, Arrow and Assignment operator*	*One Dimensional Array operations*	*Passing Array to Functions with return type*	*Accessing Array of Function Pointers*	*File permissions and rights*
	SLO-2	*Bitwise and Sizeof operator*	*Array Programs – 1D*	*Recursion Functions*	*Null Pointers*	*Changing permissions and rights*
S 18-21	SLO-1 SLO-2	*Lab 3: Data Types*	*Lab 6: Arrays – One Dimensional*	*Lab 9: Functions*	*Lab 12: Pointers*	*Lab 15: File Handling*

Learning Resources	1. ***Zed A Shaw, Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding (Like C), Addison Wesley, 2015*** 2. ***W. Kernighan, Dennis M. Ritchie, The C Programming Language, 2nd ed. Prentice Hall, 1996***	3. *Bharat Kinariwala, Tep Dobry, Programming in C, eBook* 4. **http://www.c4learn.com/learn-c-programming-language/**

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 (5%)	Practice (5%)	Theory (7.5%)	Practice (7.5%)	Theory (7.5%)	Practice (7.5%)	Theory (5%)	Practice (5%)	Theory (25%)	Practice (25%)
Level 1	Remember	10%		5%	5%	5%	5%			5%	5%
Level 2	Understand	10%		15%	5%	15%	5%	5%		15%	5%
Level 3	Apply	10%	20%	10%	10%	10%	10%	10%	20%	20%	10%
Level 4	Analyze	20%	20%	20%	20%	20%	20%	20%	10%	10%	20%
Level 5	Evaluate		10%		10%		10%				10%
Level 6	Create							15%	20%		
	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
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Course Code	18CSC201J	Course Name	DATA STRUCTURES AND ALGORITHMS	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 Objective:	The purpose of learning this course is to:
1	Searching and sorting techniques used to handle a set of data along with time and space complexity
2	List structure and its categories
3	Linear structures Stack and Queue
4	Tree structure and its applications
5	Structures Graphs and hashing and also implement them
6	Different types of data structures and use them for problem solving

Course Outcomes (CO):	At the end of this course, learners will be able to:	Learning: Level of Thinking	Expected Proficiency	Expected Attainment	Program Outcomes (PO): 1 Engineering	2 Problem Analysis	3 Design & Development	4 Analysis, Design,	5 Modern Tool Usage	6 Society & Culture	7 Environment &	8 Ethics	9 Individual & Team	10 Communication	11 Project Mgt. & Finance	12 Life Long Learning	PSO	PSO - 2	PSO – 3
		1-6			1	2	3	4	5	6	7	8	9	10	11	12			
CO-1 :	Devise algorithms to arrange the data in required order and retrieve a specific datum in efficient manner	5	60	70	3	3	3	-	-	-	-	-	-	-	-	3	-	-	3
CO-2 :	Determine the type of list structure that could be used for solving a problem and implement it using C programming language	5	60	70	3	2	2	-	-	-	-	-	-	-	-	3	-	-	3
CO-3 :	Devise solutions using linear structures Stack and Queue	5	60	70	3	2	2	-	-	-	-	-	-	-	-	3	-	-	3
CO-4 :	Express proficiency in usage of tree for solving problems	5	60	70	3	2	2	-	-	-	-	-	-	-	-	3	-	-	3
CO-5 :	Implement Hash tables for storing data and algorithms to find shortest path between nodes in a graph	5	60	70	3	2	2	-	-	-	-	-	-	-	-	3	-	-	3
CO-6 :	Device programs using appropriate data structure for solving problems	5	60	70	3	3	3	-	-	-	-	-	-	-	-	3	-	-	3

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Introduction-Basic Terminology	Array	Stack ADT	General Trees	Graph Terminology
	SLO-2	Data Structures	Operations on Arrays – Insertion and Deletion	Stack Array Implementation	Tree Terminologies	Graph Traversal
S-2	SLO-1	Data Structure Operations	Applications on Arrays	Stack Linked List Implementation	Tree Representation	Topological sorting
	SLO-2	ADT	Multidimensional Arrays- Sparse Matrix	Applications of Stack- Infix to Postfix Conversion	Tree Traversal	Minimum spanning tree – Prims Algorithm
S-3	SLO-1	Algorithms – Searching techniques	Linked List Implementation - Insertion	Applications of Stack- Postfix Evaluation	Binary Tree Representation	Minimum Spanning Tree - Kruskal's Algorithm
	SLO-2	Complexity – Time , Space Trade off	Linked List- Deletion and Search	Applications of Stack- Balancing symbols	Expression Trees	Network flow problem
S 4-5	SLO-1	Lab 1: Implementation of Searching - Linear and Binary Search Techniques	Lab 4 :Implementation of Array – Insertion, Deletion.	Lab 7 :Implementation of stack using array and Linked List	Lab 10: Implementation of Tree using array	Lab 13: Implementation of Graph using Array
	SLO-2					
S-6	SLO-1	Algorithms - Sorting	Applications of Linked List	Applications of Stack- Nested Function Calls	Binary Tree Traversal	Shortest Path Algorithm- Introduction
	SLO-2	Complexity – Time , Space Trade off	Polynomial Arithmetic	Recursion concept using stack	Threaded Binary Tree	Shortest Path Algorithm: Dijkstra's Algorithm

S-7	SLO-1	*Mathematical notations*	*Cursor Based Implementation – Methodology*	*Applications of Recursion:Tower of Hanoi*	*Binary Search Tree :Construction, Searching*	*Hashing: Hash functions - Introduction*
	SLO-2	*Asymptotic notations-Big O, Omega*	*Cursor Based Implementation*	*Queue ADT*	*Binary Search Tree : Insertion and Deletion*	*Hashing: Hash functions*
S-8	SLO-1	*Asymptotic notations - Theta*	*Circular Linked List*	*Queue Implementation using array*	*AVLTrees: Rotations*	*Hashing : Collision avoidance*
	SLO-2	*Mathematical functions*	*Circular Linked List - Implementation*	*Queue Implementation using Linked List*	*AVL Tree: Insertions*	*Hashing : Separate chaining*
S 9-10	SLO-1	*Lab 2: Implementation of sorting Techniques – Insertion sort and Bubble Sort Techniques*	*Lab 5: Implementation of Linked List - Cursor Based Implementation*	*Lab 8: Implementation of Queue using Array and linked list*	*Lab 11: Implementation of BST using linked list*	*Lab 14 :Implementation of Shortest path Algorithm*
	SLO-2					
S-11	SLO-1	*Data Structures and its Types*	*Applications of Circular List -Joseph Problem*	*Circular Queue*	*B-Trees Constructions*	*Open Addressing*
	SLO-2	*Linear and Non-Linear Data Structures*	*Doubly Linked List*	*Implementation of Circular Queue*	*B-Trees Search*	*Linear Probing*
S-12	SLO-1	*1D, 2D Array Initialization using Pointers*	*Doubly Linked List Insertion*	*Applications of Queue*	*B-Trees Deletions*	*Quadratic probing*
	SLO-2	*1D, 2D Array Accessing usingPointers*	*Doubly Linked List Insertion variations*	*Double ended queue*	*Splay Trees*	*Double Hashing*
S-13	SLO-1	*Declaring Structure and accessing*	*Doubly Linked List Deletion*	*Priority Queue*	*Red Black Trees*	*Rehashing*
	SLO-2	*Declaring Arrays of Structures and accessing*	*Doubly Linked List Search*	*Priority Queue - Applications*	*Red Black Trees Insertion*	*Extensible Hashing*
S 14-15	SLO-1	*Lab 3: Implement Structures using Pointers*	*Lab 6: Implementation of Doubly linked List*	*Lab 9: Applications of Stack, Queue*	*Lab 12:Implementation of B-Trees*	*Lab 15 :Implementation of Minimal Spanning Tree*
	SLO-2					

Learning Resources	1. *Seymour Lipschutz, Data Structures with C, McGraw Hill, 2014* 2. *R.F.Gilberg, B.A.Forouzan, Data Structures, 2nd ed., Thomson India, 2005* 3. *A.V.Aho, J.E Hopcroft , J.D.Ullman, Data structures and Algorithms, Pearson Education, 2003* 4. *Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd ed., Pearson Education, 2015*	5. *Reema Thareja, Data Structures Using C, 1st ed., Oxford Higher Education, 2011* 6. *Thomas H Cormen, Charles E Leiserson, Ronald L Revest, Clifford Stein, Introduction to Algorithms 3rd ed., The MIT Press Cambridge, 2014*

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 (5%)	Practice (5%)	Theory (7.5%)	Practice (7.5%)	Theory (7.5%)	Practice (7.5%)	Theory (5%)	Practice (5%)	Theory (25%)	Practice (25%)
Level 1	Remember	20%		15%		15%				15%	
Level 2	Understand	20%		25%		25%		20%		20%	
Level 3	Apply	45%	30%	40%	35%	40%	40%	25%	20%	45%	30%
Level 4	Analyze	15%	40%	20%	35%	20%	30%	20%	50%	20%	35%
Level 5	Evaluate		30%		30%		30%	25%	30%		35%
Level 6	Create										
	Total	100 %	100 %	100 %	100 %	100 %	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. Dr. Nagaveer, CEO, Campus Corporate Connect,nagaveer@campuscorporateconnect.com	*1. Dr. Srinivasa Rao Bakshi, IITM, Chennai, sbakshi@iitm.ac.in*	*1. Mr. K. Venkatesh, SRMIST*
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	3. Dr.Noor Mahammad, IIITDM, Kancheepuram,noor@iiitdm.ac.in	*3. Ms. Ferni Ukrit, SRMIST*

Course Code	18CSC202J	Course Name	OBJECT ORIENTED DESIGN AND PROGRAMMING	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 Objective	The purpose of learning this course is to:	Learning
1	Class and domain model for real-time programs	1-6
2	Method overloading and operator overloading for real-time application development programs	
3	Inline, friend and virtual functions and create application development programs	
4	Exceptional handling and collections for real-time object-oriented programming applications	
5	UML component diagram and deployment diagram for design of applications	
6	Programs using object-oriented approach and design methodologies for real-time application development	

Course Outcome:	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Program Learning Outcomes (PO) 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
CO1	Identify the class and build domain model	4	60	70	3	3	2	-	-	-	-	-	2	2	-	-	3	2	2
CO2	Construct programs using method overloading and operator overloading	4	60	70	3	2	2	2	2	-	-	-	2	1	-	-	2	3	1
CO3	Create programs using inline, friend and virtual functions, construct programs using standard templates	4	60	70	3	2	2	2	2	-	-	-	-	1	-	-	2	3	1
CO4	Construct programs using exceptional handling and collections	4	60	70	3	2	2	-	-	-	-	-	-	1	-	-	2	3	1
CO5	Create UML Use case, Static and Dynamic Diagrams	4	60	70	2	2	2	2	2	-	-	-	1	2	-	-	2	2	2
CO6	Create programs using object-oriented approach and design methodologies	4	60	70	1	2	2	-	-	-	-	-	2	2	-	-	3	2	2

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Comparison of Procedural and Object-Oriented Programming	Types of constructor (Default, Parameter)	Feature Inheritance: Single and Multiple	Generic - Templates: Introduction	STL: Containers: Sequence and Associative Container
	SLO-2	OOPS and its features	Static constructor and copy constructor	Inheritance: Multilevel	Function templates	
S-2	SLO-1	I/O Operations, Data Types, Variables, static	Feature Polymorphism: Constructor overloading	Inheritance: Hierarchical	Example programs Function templates	Sequence Container: Vector, List
	SLO-2	Constants, Pointers, Type Conversions	Method Overloading	Inheritance: Hybrid	Class Templates	Sequence Container: Deque, Array
S-3	SLO-1	Features: Class and Objects	Example for method overloading	Inheritance: Example Programs	Class Templates	STL : Stack
	SLO-2	UML Diagrams Introduction	Method Overloading: Different parameter with different return values		Example programs for Class and Function templates	
S	SLO-1	Lab 1: I/O operations	Lab 4: Constructor and Method overloading	Lab 7: Inheritance and its types	Lab 10: Templates	Lab 13: STL Containers

4-5	SLO-2					
S-6	SLO-1	*Feature: Class and Objects*	*Operator Overloading and types*	*Advanced Functions: Inline, Friend*	*Exceptional Handling: try and catch*	*Associative Containers: Map, Multimap*
	SLO-2	*Examples of Class and Objects*	*Overloading Assignment Operator*	*Advanced Functions: Virtual, Overriding*	*Exceptional Handling: Multilevel exceptional*	
S-7	SLO-1	*UML Class Diagram and its components*	*Overloading Unary Operators*	*Advanced Function: Pure Virtual function*	*Exceptional Handling: throw and throws*	*Iterator and Specialized iterator*
	SLO-2	*Class Diagram relations and Multiplicity*	*Example for Unary Operator overloading*	*Example for Virtual and pure virtual function*	*Exceptional Handling: finally*	*Functions of iterator*
S-8	SLO-1	*Feature Abstraction and Encapsulation*	*Overloading Binary Operators*	*Abstract class and Interface*	*Exceptional Handling: User defined exceptional*	*Algorithms: find(), count(), sort()*
	SLO-2	*Application of Abstraction and Encapsulation*	*Example for Binary Operator overloading*	*Example Program*	*Example Programs using C++*	*Algorithms: search(), merge()*
S 9-10	SLO-1	*Lab 2: Classes and Objects, Class Diagram*	*Lab 5: Polymorphism: Operators Overloading*	*Lab 8: Virtual Function and Abstract class*	*Lab 11: Exceptional Handling*	*Lab 15: STL Associative containers and algorithms*
	SLO-2					
S-11	SLO-1	*Access specifiers – public, private*	*UML Interaction Diagrams*	*UML State Chart Diagram*	*Dynamic Modeling: Package Diagram*	*Function Object: for_each(), transform()*
	SLO-2	*Access specifiers - protected, friend, inline*	*Sequence Diagram*	*UML State Chart Diagram*	*UML Component Diagram*	*Example for Algorithms*
S-12	SLO-1	*UML use case Diagram, use case, Scenario*	*Collaboration Diagram*	*Example State Chart Diagram*	*UML Component Diagram*	*Streams and Files: Introduction*
	SLO-2	*Use case Diagram objects and relations*	*Example Diagram*	*UML Activity Diagram*	*UML Deployment Diagram*	*Classes and Errors*
S-13	SLO-1	*Method, Constructor and Destructor*	*Feature: Inheritance*	*UML Activity Diagram*	*UML Deployment Diagram*	*Disk File Handling Reading Data and Writing Data*
	SLO-2	*Example program for constructor*	*Inheritance and its types*	*Example Activity Diagram*	*Example Package, Deployment, Package*	
S 14 - 15	SLO-1	*Lab 3: Methods and Constructor, Usecase*	*Lab 6: UML Interaction Diagram*	*Lab 9: State Chart and Activity Diagram*	*Lab12 : UML Component, Deployment, Package diagram*	*Lab15: Streams and File Handling*
	SLO-2					

Learning Resources	1. *Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Object-Oriented Analysis and Design with Applications, 3rd ed., Addison-Wesley, May 2007* 2. *Reema Thareja, Object Oriented Programming with C++, 1st ed., Oxford University Press, 2015* 3. *Sourav Sahay, Object Oriented Programming with C++, 2nd ed., Oxford University Press, 2017*	4. *Robert Lafore, Object-Oriented Programming in C++, 4th ed., SAMS Publishing, 2008* 5. *Ali Bahrami, Object Oriented Systems Development", McGraw Hill, 2004* 6. *Craig Larmen, Applying UML and Patterns, 3rd ed., Prentice Hall, 2004*

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 %*	*10%*	*20 %*	*10%*	*20 %*	*10%*			*20 %*	*10%*
Level 2	**Understand**	*20 %*	*10%*	*20 %*	*10%*	*20 %*	*10%*			*20 %*	*10%*
Level 3	**Apply**	*60 %*	*40%*	*60 %*	*40%*	*40 %*	*40%*	*40 %*	*40%*	*40 %*	*40%*

Level 4	**Analyze**		40%		40%	*20 %*	40%	60%	60%	*20 %*	40%
Level 5	**Evaluate**										
Level 6	**Create**										
	Total	*100 %*	*100 %*	*100 %*	*100 %*	*100 %*	*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
For the laboratory component the students are advised to take an application and apply the concepts

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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		3. Mr. Geogen George, SRMIST
		4. Mr. Muthukumaran, SRMIST

Course Code	18CSC203J	Course Name	COMPUTER ORGANIZATION AND ARCHITECTURE	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 Objective:	The purpose of learning this course is to:
1	Functional units of a computer, 8086 instructions to write ALP.
2	Analyze the functions of arithmetic Units like adders, subtractors and multipliers etc.
3	Basic processing units and Concepts of Pipelining
4	Study about parallel processing and performance considerations.
5	Detailed study on Input-Output organization and Memory Systems.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Learning 1-6: Level of Thinking	Expected Proficiency	Expected Attainment	PLO 1 Engineering	PLO 2 Problem Analysis	PLO 3 Design & Development	PLO 4 Analysis, Design,	PLO 5 Modern Tool Usage	PLO 6 Society & Culture	PLO 7 Environment &	PLO 8 Ethics	PLO 9 Individual & Team	PLO 10 Communication	PLO 11 Project Mgt. & Finance	PLO 12 Life Long Learning	PSO PSO - 1	PSO - 2	PSO – 3
CO-1	Identify the different components of computer hardware and how software interacts with the hardware and write ALP using 8086 instructions.	4	60	70	3	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO-2	Apply Boolean algebra as related to designing computer logic, through simple combinational and sequential logic circuits.	4	60	70	3	3	3	-	-	-	-	-				2	-	-	3
CO-3	Analyze the detailed operation of Basic Processing units and the performance of Pipelining.	4	60	70	3	2	-	-	-	-	-	-				2	-	-	-
CO-4	Express the concepts of parallelism and components in multi-core processors.	4	60	70	3	-	-	-	-	-	-	-				2	-	-	-
CO-5	Exhibit knowledge on memory technologies, input-output systems and evaluate the performance of memory system	4	60	70	3	-	3	-	-	-	-	-				2	-	-	-
																	-	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	*Functional Units of a computer*	*Addition and subtraction of Signed numbers*	***Fundamental concepts of basic processing unit***	*Parallelism*	***Memory systems -Basic Concepts***
	SLO-2	*Operational concepts*	***Problem solving***	***Performing ALU operation***	*Need, types of Parallelism*	*Memory hierarchy*
S-2	SLO-1	*Bus structures*	***Design of fast adders***	***Execution of complete instruction, Branch instruction***	*applications of Parallelism*	*Memory technologies*
	SLO-2	*Memory locations and addresses*	***Ripple carry adder and Carry look ahead adder***	***Multiple bus organization***	*Parallelism in Software*	***RAM, Semiconductor RAM***
S-3	SLO-1	*Memory operations*	*Multiplication of positive numbers*	***Hardwired control***	*Instruction level parallelism*	***ROM,Types***
	SLO-2	*Memory operations*	***Problem Solving***	***Generation of control signals***	*Data level parallelism*	***Speed,size cost***
S 4-5	SLO-1 SLO-2	*Lab 1: To recognize various components of PC-**Input Output systems** Processing and Memory units*	*Lab4:Study of TASM Addition and Subtraction of 8-bit number*	*Lab-7: Design of Half Adder Design of Full Adder*	*Lab-10: Study of Array Multiplier Design of Array Multiplier*	*Lab-13: Study of Carry Save Multiplication Program to carry out Carry Save Multiplication*
S-6	SLO-1	*Instructions, **Instruction sequencing***	*Signed operand multiplication*	***Micro-programmed control-***	***Challenges in parallel processing***	*Cache memory*
	SLO-2	*Addressing modes*	***Problem solving***	***Microinstruction***	***Architectures of Parallel Systems - Flynn's classification***	*Mapping Functions*

S-7	SLO-1	***Problem solving***	*Fast multiplication- Bit pair recoding of Multipliers*	***Micro-program Sequencing***	***SISD,SIMD***	***Replacement Algorithms***
	SLO-2	*Introduction to Microprocessor*	***Problem Solving***	***Micro instruction with Next address field***	***MIMD, MISD***	***Problem Solving***
S-8	SLO-1	*Introduction to Assembly language*	*Carry Save Addition of summands*	***Basic concepts of pipelining***	***Hardware multithreading***	***Virtual Memory***
	SLO-2	*Writing of assembly language programming*	***Problem Solving***	***Pipeline Performance***	***Coarse Grain parallelism, Fine Grain parallelism***	*Performance considerations of various memories*
S 9-10	SLO-1	*Lab-2:To understand how different components of PC are connected to work properly Assembling of System Components*	*Lab 5: Addition of 16-bit number Subtraction of 16-bit number*	*Lab-8: Study of Ripple Carry Adder Design of Ripple Carry Adder*	*Lab-11: Study of Booth Algorithm*	*Lab-14: Understanding Processing unit Design of primitive processing unit*
	SLO-2					
S-11	SLO-1	*ARM Processor: The thumb instruction set*	*Integer division – Restoring Division*	***Pipeline Hazards-Data hazards***	***Uni-processor and Multiprocessors***	*Input Output Organization*
	SLO-2	*Processor and CPU cores*	***Solving Problems***	*Methods to overcome Data hazards*	***Multi-core processors***	*Need for Input output devices*
S-12	SLO-1	***Instruction Encoding format***	*Non Restoring Division*	*Instruction Hazards*	***Multi-core processors***	*Memory mapped IO*
	SLO-2	***Memory load and Store instruction in ARM***	***Solving Problems***	*Hazards on conditional and Unconditional Branching*	***Memory in Multiprocessor Systems***	*Program controlled IO*
S-13	SLO-1	*Basics of IO operations.*	*Floating point numbers and operations*	*Control hazards*	***Cache Coherency in Multiprocessor Systems***	*Interrupts-Hardware, Enabling and Disabling Interrupts*
	SLO-2	*Basics of IO operations.*	***Solving Problems***	*Influence of hazards on instruction sets*	***MESI protocol for Multiprocessor Systems***	*Handling multiple Devices*
S 14-15	SLO-1	*Lab -3To understand how different components of PC are connected to work properly Disassembling of System Components*	*Lab-6: Multiplication of 8-bit number Factorial of a given number*	*Lab-9: Study of Carry Look-ahead Adder Design of Carry Look-ahead Adder*	*Lab-12: Program to carry out Booth Algorithm*	*Lab-15: Understanding Pipeline concepts* ***Design of basic pipeline.***
	SLO-2					

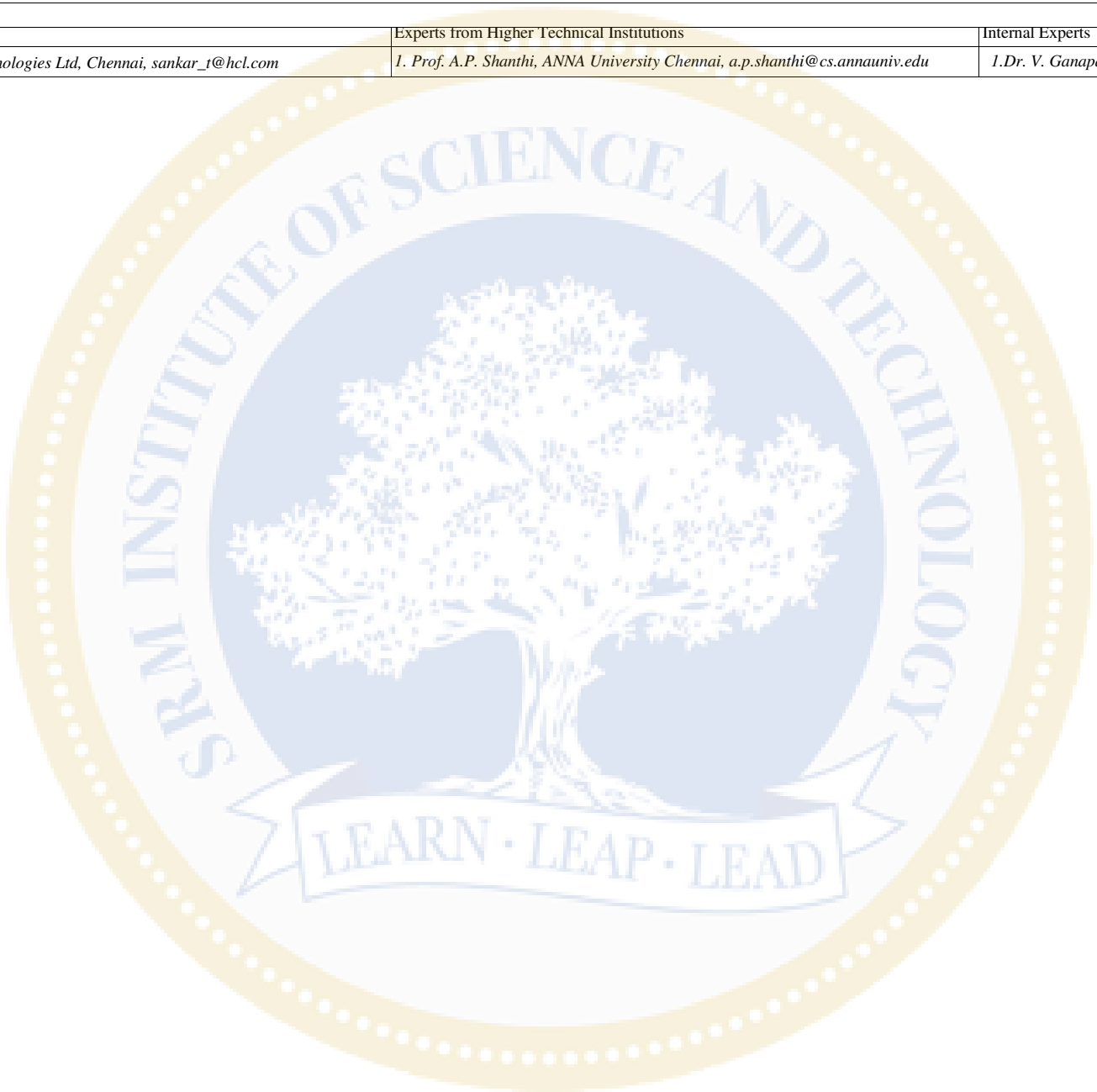
Learning Resources	1. *Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer Organization, 5th ed., McGraw-Hill, 2015* 2. *Kai Hwang, Faye A. Briggs, Computer Architecture and Parallel Processing", 3rd ed., McGraw Hill, 2016* 3. *Ghosh T. K., Computer Organization and Architecture, 3rd ed., Tata McGraw-Hill, 2011* 4. *P. Hayes, Computer Architecture and Organization, 3rd ed., McGraw Hill, 2015.* 5. *William Stallings, Computer Organization and Architecture – Designing for Performance, 10th ed., Pearson Education, 2015* 6. *David A. Patterson and John L. Hennessy Computer Organization and Design - A Hardware software interface, 5th ed., Morgan Kaufmann,2014*

Learning Assessment

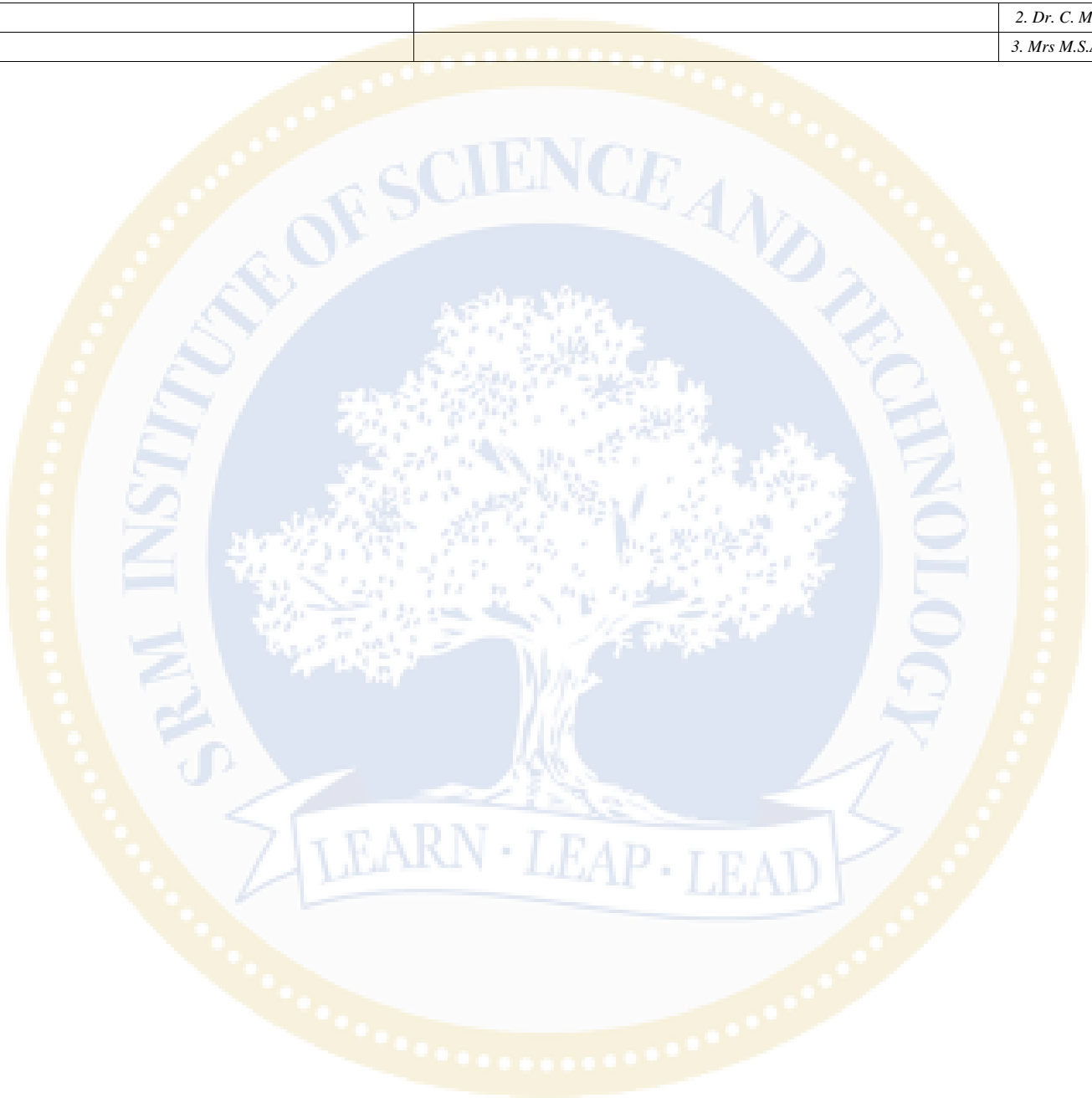
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)			
		Theory (5%)	Practice (5%)	Theory (7.5%)	Practice (7.5%)	Theory (7.5%)	Practice (7.5%)	Theory (5%)	Practice (5%)	Theory (25%)	Practice (25%)
Level 1	Remember	15%		10%		10%	10%			15%	
Level 2	Understand	15%	10%	10%	10%	10%	10%	15%	10%	20%	10%
Level 3	Apply	20%	20%	20%	20%	15%	15%	15%	20%	15%	20%
Level 4	Analyze		20%	10%	20%	15%		20%	10%		20%
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.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. *T. V. Sankar, HCL Technologies Ltd, Chennai, sankar_t@hcl.com*	*1. Prof. A.P. Shanthi, ANNA University Chennai, a.p.shanthi@cs.annauniv.edu*	*1.Dr. V. Ganapathy, SRMIST*



		2. Dr. C. Malathy, SRMIST
		3. Mrs M.S.Abirami, SRMIST



Course Code	18CSC204J	Course Name	DESIGN AND ANALYSIS OF ALGORITHMS	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 Objective:	*The purpose of learning this course is to:*
1	*Learn efficient algorithms in solving complex real time problems*
2	*Identify various algorithm design techniques to solve real time problems in polynomial time*
3	*Understand various approaches to solve greedy and dynamic algorithms*
4	*Utilize backtracking and branch bound paradigms to solve exponential time problems*
5	*Learn the need of approximation and randomization algorithms, utilize the importance Non polynomial algorithms*
6	*Learn algorithms that are efficient in space and time complexities*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	**Learning**			**Program Outcomes (PO)**												Program Specific Outcomes (PSO)		
		1- 6			1	2	3	4	5	6	7	8	9	10	11	12			
		Level of Thinking	Expected	Expected	Engineering	Problem Analysis	Design &	Analysis, Design,	Modern Tool Usage	Society & Culture	Environment &	Ethics	Individual & Team	Communication	Project Mgt. &	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CO-1 :	*Apply efficient algorithms to reduce space and time complexity of both recurrent and non-recurrent relations*	*4*	*60*	*70*	*2*	*3*	-	-	-	-	-	-	-	-	-	-	-	-	*3*
CO-2 :	*Solve problems using divide and conquer approaches*	*4*	*60*	*70*	-	*3*	*2*	-	-	-	-	-	-	-	-	-	-	-	*3*
CO-3 :	*Apply greedy and dynamic programming techniques to solve polynomial time problems.*	*4*	*60*	*70*	-	*3*	*3*	-	-	-	-	-	-	-	-	-	-	-	*3*
CO-4 :	*Construct exponential problems using backtracking and branch and bound approaches.*	*4*	*60*	*70*	*3*	*2*	*3*	-	-	-	-	-	-	-	-	-	-	-	*3*
CO-5 :	*Interpret various approximation algorithms and interpret solutions to evaluate P type, NP Type, NPC, NP Hard problems*	*4*	*60*	*70*	*2*	*3*	-	-	-	-	-	-	-	-	-	-	-	-	*3*
CO-6 :	*Create algorithms that are efficient in time complexities by using divide conquer, greedy, backtracking ,branch and bound and randomization approaches*	*4*	*60*	*70*	-	*2*	*3*	-	-	-	-	-	-	-	-	-	-	-	*3*

Duration (hour)		15	15	15	15	15
S-1	SLO-1	*Introduction-Algorithm Design*	*Introduction-Divide and Conquer*	*Introduction-Greedy and Dynamic Programming*	*Introduction to backtracking - branch and bound*	*Introduction to randomization and approximation algorithm*
	SLO-2	*Fundamentals of Algorithms*	*Maximum Subarray Problem*	*Examples of problems that can be solved by using greedy and dynamic approach*	*N queen's problem - backtracking*	*Randomized hiring problem*
S-2	SLO-1	*Correctness of algorithm*	*Binary Search*	*Huffman coding using greedy approach*	*Sum of subsets using backtracking*	*Randomized quick sort*
	SLO-2	*Time complexity analysis*	*Complexity of binary search*	*Comparison of brute force and Huffman method of encoding*	*Complexity calculation of sum of subsets*	*Complexity analysis*
S-3	SLO-1	*Insertion sort-Line count, Operation count*	*Merge sort*	*Knapsack problem using greedy approach*	*Graph introduction*	*String matching algorithm*
	SLO-2	*Algorithm Design paradigms*	*Time complexity analysis*	*Complexity derivation of knapsack using greedy*	*Hamiltonian circuit - backtracking*	*Examples*
S 4-5	SLO-1 SLO-2	*Lab 1: Simple Algorithm-Insertion sort*	*Lab 4: Quicksort, Binary search*	*Lab 7: Huffman coding, knapsack and using greedy*	*Lab 10: N queen's problem*	*Lab 13: Randomized quick sort*
S-6	SLO-1	*Designing an algorithm*	*Quick sort and its Time complexity analysis*	*Tree traversals*	*Branch and bound - Knapsack problem*	*Rabin Karp algorithm for string matching*
	SLO-2	*And its analysis-Best, Worst and Average case*	*Best case, Worst case, Average case analysis*	*Minimum spanning tree - greedy Kruskal's algorithm - greedy*	*Example and complexity calculation. Differentiate with dynamic and greedy*	*Example discussion*

S-7	SLO-1	*Asymptotic notations Based on growth functions.*	*Strassen's Matrix multiplication and its recurrence relation*	*Minimum spanning tree - Prims algorithm*	*Travelling salesman problem using branch and bound*	*Approximation algorithm*
	SLO-2	*O,O,Θ, ω, Ω*	*Time complexity analysis of Merge sort*	*Introduction to dynamic programming*	*Travelling salesman problem using branch and bound example*	*Vertex covering*
S-8	SLO-1	*Mathematical analysis*	*Largest sub-array sum*	*0/1 knapsack problem*	*Travelling salesman problem using branch and bound example*	*Introduction Complexity classes*
	SLO-2	*Induction, Recurrence relations*	*Time complexity analysis of Largest sub-array sum*	*Complexity calculation of knapsack problem*	*Time complexity calculation with an example*	*P type problems*
S 9-10	SLO-1 SLO-2	*Lab 2: Bubble Sort*	*Lab 5: Strassen Matrix multiplication*	*Lab 8: Various tree traversals, Krukshall's MST*	*Lab 11: Travelling salesman problem*	*Lab 14: String matching algorithms*
S-11	SLO-1	*Solution of recurrence relations*	*Master Theorem Proof*	*Matrix chain multiplication using dynamic programming*	*Graph algorithms*	*Introduction to NP type problems*
	SLO-2	*Substitution method*	*Master theorem examples*	*Complexity of matrix chain multiplication*	*Depth first search and Breadth first search*	*Hamiltonian cycle problem*
S-12	SLO-1	*Solution of recurrence relations*	*Finding Maximum and Minimum in an array*	*Longest common subsequence using dynamic programming*	*Shortest path introduction*	*NP complete problem introduction*
	SLO-2	*Recursion tree*	*Time complexity analysis-Examples*	*Explanation of LCS with an example*	*Floyd-Warshall Introduction*	*Satisfiability problem*
S-13	SLO-1	*Solution of recurrence relations*	*Algorithm for finding closest pair problem*	*Optimal binary search tree (OBST)using dynamic programming*	*Floyd-Warshall with sample graph*	*NP hard problems*
	SLO-2	*Examples*	*Convex Hull problem*	*Explanation of OBST with an example.*	*Floyd-Warshall complexity*	*Examples*
S 14-15	SLO-1 SLO-2	*Lab 3: Recurrence Type-Merge sort, Linear search*	*Lab 6: Finding Maximum and Minimum in an array, Convex Hull problem*	*Lab 9: Longest common subsequence*	*Lab 12: BFS and DFS implementation with array*	*Lab 15: Discussion over analyzing a real time problem*

Learning Resources	1. *Thomas H Cormen, Charles E Leiserson, Ronald L Revest, Clifford Stein, Introduction to Algorithms, 3rd ed., The MIT Press Cambridge, 2014* 2. *Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd ed., Pearson Education, 2006*	3. *Ellis Horowitz, Sartajsahni, Sanguthevar, Rajesekaran, Fundamentals of Computer Algorithms, Galgotia Publication, 2010* 4. *S. Sridhar, Design and Analysis of Algorithms, Oxford University Press, 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%*		*10%*		*10%*		*10%*		*10%*	-
Level 2	Understand	20%	30%	25%	30%	25%	30%	25%	30%	25%	30%
Level 3	Apply	*35%*	*30%*	*45%*	*30%*	*45%*	*30%*	*45%*	*30%*	*45%*	*30%*
Level 4	Analyze	25%	40%	20%	40%	20%	40%	20%	40%	20%	40%
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %	100 %	100 %	100 %	100 %	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. G. Venkiteswaran, Wipro Technologies, gvenki@pilani.bits-pilani.ac.in	*1. MiteshKhapra, IITM Chennai, miteshk@cse.iitm.ac.in*	*1. Mr.K.Senthil Kumar, SRMIST*
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		3. Mr. V. Sivakumar, SRMIST
		4. Ms. R. Vidhya, SRMIST

Course Code	18CSC205J	Course Name	OPERATING SYSTEMS	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 Objectives:	The purpose of learning this course is to:
1	Introduce the key role of an Operating system
2	Insist the Process Management functions of an Operating system
3	Emphasize the importance of Memory Management concepts of an Operating system
4	Realize the significance of Device Management part of an Operating system
5	Comprehend the need of File Management functions of an Operating system
6	Explore the services offered by the Operating system practically

Course Outcomes (CO):	At the end of this course, learners will be able to:	Learning 1 - 6			Program Outcomes (PO)												PSO		
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	1 Engineering Knowledge	2 Problem Analysis	3 Design & Development	4 Analysis, Design, Research	5 Modern Tool Usage	6 Society & Culture	7 Environment & Sustainability	8 Ethics	9 Individual & Team Work	10 Communication	11 Project Mgt. & Finance	12 Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CO1 :	Express the fundamental concepts in Operating Systems.	5	60	70	3	-	3	-	-	-	-	-	-	-	-	-	2	-	-
CO2 :	Implement synchronization and scheduling in Operating System	5	60	70	2	1	3	-	-	-	-	-	-	-	-	-	-	2	-
CO3 :	Apply fragmentation, paging and segmentation in memory management.	5	60	70	3	2	2	-	-	-	-	-	-	-	-	-	2	-	-
CO4 :	Incorporate page fault handling, demand paging and page buffering techniques in Operating System.	5	60	70	3	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO5 :	Demonstrate the storage management techniques through various File Management techniques	5	60	70	3	-	2	2	-	-	-	-	-	-	-	-	2	-	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Operating System Objectives and Functions	PROCESS SYNCHRONIZATION : Peterson's solution, Synchronization Hardware	MEMORY MANAGEMENT: Memory Management: Logical Vs Physical address space, Swapping	VIRTUAL MEMORY– Background	STORAGE MANAGEMENT : Mass storage structure – Overview of Mass storage structure – Magnetic Disks
	SLO-2	Gaining the role of Operating systems	Understanding the two-process solution and the benefits of the synchronization hardware	Understanding the basics of Memory management	Understanding the need of demand paging	Understanding the Basics in storage management
S-2	SLO-1	The evolution of operating system, Major achievements	Process synchronization: Semaphores, usage, implementation	Contiguous Memory allocation – Fixed and Dynamic partition	VIRTUAL MEMORY – Basic concepts – page fault handling	Disk Scheduling
	SLO-2	Understanding the evolution of Operating systems from early batch processing systems to modern complex systems	Gaining the knowledge of the usage of the semaphores for the Mutual exclusion mechanisms	Getting to know about Partition memory management and issues: Internal fragmentation and external fragmentation problems	Understanding , how an OS handles the page faults	Understanding the various scheduling with respect to the disk
S-3	SLO-1	OS Design considerations for Multiprocessor and Multicore	Classical Problems of synchronization – Readers writers problem, Bounded Buffer problem	Strategies for selecting free holes in Dynamic partition	Performance of Demand paging	FILE SYSTEM INTERFACE: File concept, File access methods
	SLO-2	Understanding the key design issues of Multiprocessor Operating systems and Multicore Operating systems	Good understanding of synchronization mechanisms	Understanding the allocation strategies with examples	Understanding the relationship of effective access time and the page fault rate	Understanding the file basics
S 4-5	SLO-1 / SLO-2	LAB 1 : Understanding the booting process of Linux	LAB4 : System admin commands – Basics	LAB7: Shell Programs – Basic level	LAB10 : Overlay concept	LAB13:Process synchronization
S-6	SLO-1	PROCESS CONCEPT– Processes, PCB	Classical Problems of synchronization – Dining Philosophers problem (Monitor)	Paged memory management	Copy-on write	File sharing and Protection
	SLO-2	Understanding the Process concept and Maintanance of PCB by OS	Understanding the synchronization of limited resources among multiple processes	Understanding the Paging technique.PMT hardware mechanism	Understanding the need for Copy-on write	Emphasis the need for the file sharing and its protection
S-7	SLO-1	Threads – Overview and its Benefits	CPU SCHEDULING : FCFS,SJF,Priority	Structure of Page Map Table	Page replacement Mechanisms: FIFO, Optimal, LRU and LRU approximation Techniques	FILE SYSTEM IMPLEMENTATION : File system structure

	SLO-2	***Understanding the importance of threads***	***Understanding the scheduling techniques***	***Understanding the components of PMT***	*Understanding the Pros and cons of the page replacement techniques*	***To get the basic file system structure***
S-8	SLO-1	*Process Scheduling : Scheduling Queues, Schedulers, Context switch*	*CPU Scheduling: Round robin, Multilevel queue Scheduling, Multilevel feedback Scheduling*	***Example : Intel 32 bit and 64 –bit Architectures***	***Counting based page replacement and Page Buffering Algorithms***	*Directory Implementation*
	SLO-2	*Understanding basics of Process scheduling*	*Understanding the scheduling techniques*	***Understanding the Paging in the Intel architectures***	***To know on additional Techniques available for page replacement strategies***	*Understanding the various levels of directory structure*
S 9-10	SLO-1	*LAB2 : Understanding the Linux file system*	*LAB5: System admin commands – Simple task automations*	*LAB 8:Process Creation*	*LAB11: IPC using Pipes*	*LAB14 : Study of OS161*
	SLO-2					
S-11	SLO-1	*Operations on Process – Process creation, Process termination*	*Real Time scheduling: Rate Monotonic Scheduling and Deadline Scheduling*	*Example : ARM Architectures*	*Allocation of Frames - Global Vs Local Allocation*	***FILE SYSTEM IMPLEMENTATION :Allocation methods***
	SLO-2	*Understanding the system calls – fork(),wait(),exit()*	*Understanding the real time scheduling*	*Understanding the Paging with respect to ARM*	*Understanding the root cause of the Thrashing*	*Understanding the pros and Cons of various disk allocation methods*
S-12	SLO-1	*Inter Process communication : Shared Memory, Message Passing ,Pipe()*	*DEADLOCKS: Necessary conditions, Resource allocation graph, Deadlock prevention methods*	***Segmented memory management***	*Thrashing, Causes of Thrashing*	***FILE SYSTEM IMPLEMENTATION :Free space Management***
	SLO-2	*Understanding the need for IPC*	*Understanding the deadlock scenario*	***Understanding the users view of memory with respect to the primary memory***	*Understanding the Thrashing*	*Understanding the methods available for maintaining the free spaces in the disk*
S-13	SLO-1	*PROCESS SYNCHRONIZATION: Background, Critical section Problem*	*Deadlocks :Deadlock Avoidance, Detection and Recovery*	*Paged segmentation Technique*	*Working set Model*	*Swap space Management*
	SLO-2	*Understanding the race conditions and the need for the Process synchronization*	*Understanding the deadlock avoidance, detection and recovery mechanisms*	*Understanding the combined scheme for efficient management*	*Understanding the working set model for controlling the Working set Model*	*Understanding the Low-level task of the OS*
S 14-15	SLO-1	*LAB3: Understanding the various Phases of Compilation of a 'C' Program*	*LAB6 : Linux commands*	*LAB9: Overlay concept*	*LAB12: IPC using shared memory and Message queues*	*LAB15 : Understanding the OS161 filesystem and working with test programs*
	SLO-2					

Learning Resources	1. *Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating systems, 9th ed., John Wiley & Sons, 2013* 2. *William Stallings, Operating Systems-Internals and Design Principles, 7th ed., Prentice Hall, 2012*	3. *Andrew S.Tanenbaum, Herbert Bos, Modern Operating systems, 4th ed., Pearson, 2015* 4. *Bryant O'Hallaxn, Computer systems- A Programmer's Perspective,Pearson, 2015*

Learning Assessment

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		Theory (5%)	Practice (5%)	Theory (7.5%)	Practice (7.5%)	Theory (7.5%)	Practice (7.5%)	Theory (5%)	Practice (5%)	Theory (25%)	Practice (25%)
Level 1	Remember	20%		15%		15%				15%	
Level 2	Understand	20%		25%		25%		25%		20%	
Level 3	Apply	45%	30%	40%	35%	40%	40%	20%	20%	45%	30%
Level 4	Analyze	15%	40%	20%	35%	20%	30%	20%	50%	20%	35%
Level 5	Evaluate		30%		30%		30%	25%	30%		35%
Level 6	Create										
	Total	100 %	100 %	100 %	100 %	100 %	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.Mr. Balamurugan, Infosys, balams@gmail.com	*1.* ***Dr.Latha Parthiban, Pondicherry University, lathaparthiban@yahoo.com***	***1. Dr .G. Maragatham, SRMIST***	***3. Ms. Aruna S, SRMIST***
		2. Dr. M. Eliazer, SRMIST	

Course Code	18CSC206J	Course Name	SOFTWARE ENGINEERING AND PROJECT MANAGEMENT	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 Objectives	The purpose of learning this course is to:	Learning
1	Familiarize the software life cycle models and software development process	1 to 6
2	Understand the various technique for requirements, planning and managing a technology project	
3	Examine basic methodologies for software design, development, testing, closure and implementation	
4	Understand manage users expectations and the software development team	
5	Acquire the latest industry knowledge, tools and comply to the latest global standard for project management	

Course Outcomes (CO):	At the end of this course, learners will be able to:	Level of Thinking	Expected Proficiency	Expected Attainment
CO-1 :	Identify the process of project life cycle model and process	5	60	70
CO-2 :	Analyse and specify software requirements through a productive working relationship with project stakeholders	5	60	70
CO-3 :	Design the system based on Functional Oriented and Object Oriented Approach for Software Design	5	60	70
CO-4 :	Develop the correct and robust code for the software products	6	60	70
CO-5 :	Create test plan and perform testing of the developed project	5	60	70

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

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Introduction to Software Engineering	Software Design - Software Design Fundamentals	Software Construction	Introduction to testing	Product Release
	SLO-2	Software Project Management - life cycle activities	Design Standards - Design Type	Coding Standards	Verification	Product Release
S-2	SLO-1	Traditional – Waterfall, V Model	Design model – Architectural design, Software architecture	Coding Framework	Validation	Product Release Management
	SLO-2	Prototype, Spiral, RAD	Software Design Methods	Reviews - Desk checks (Peer Reviews)	Test Strategy	Product Release Management
S-3	SLO-1	Conventional – Agile,	Top Down , Bottom Up	Walkthroughs	Planning	Implementation
	SLO-2	XP, Scrum	Module Division (Refactoring)	Code Reviews, Inspections	Example: Test Strategy and Planning	Implementation
S 4-5	SLO-1	Lab1:Identify the Software Project, Create Business Case, Arrive at a Problem Statement	Lab 4:Prepare Project Plan based on scope, Find Job roles and responsibilities, Calculate Project effort based on resources	Lab 7:State and Sequence Diagram, Deployment Diagram, Sample Frontend Design (UI/UX)	Lab 10: Module Implementation (Phase 2), Scrum Master to Induce New Issues in Agile Development	Lab 13:Manual Testing
	SLO-2					
S-6	SLO-1	Introduction to Requirement Engineering	Module Coupling	Coding Methods	Test Project Monitoring and Control	User Training
	SLO-2	Requirements Elicitation	Component level design	Structured Programming	Test Project Monitoring and Control	Maintenance Introduction
S-7	SLO-1	Software Project Effort and cost estimation	User Interface Design	Object-Oriented Programming	Test Project Monitoring and Control	Maintenance Types - Corrective
	SLO-2	Cost estimation	Pattern oriented design	Automatic Code Generation	Test Project Monitoring and Control	Adaptive
S-8	SLO-1	Cocomo 1 and 2	Web application design	Automatic Code Generation	Test Project Monitoring and Control	Perfective
	SLO-2	Cocomo 1 and 2	Web application design	Automatic Code Generation	Test Project Monitoring and Control	Preventive
S 9-10	SLO-1	Lab 2:Stakeholder and User Description, Identify the appropriate Process Model, Comparative study with Agile Model	Lab 5:Prepare the Work, Breakdown Structure based on timelines, Risk Identification and Plan	Lab 8:Module Description, Module Implementation (phase 1) Using Agile	Lab 11:Module Implementation (Phase 3) Scrum Master to Induce New requirements in Agile Development, Scrum Master to Induce New Issues in Agile Development, Code Documentation	Lab 14:User Manual, Analysis of Costing, Effort and Resources
	SLO-2					
S-11	SLO-1	Risk Management	Design Reuse	Software Code Reuse	Design –Master test plan, types	Maintenance Cost
	SLO-2	Risk Management	Design Reuse	Software Code Reuse	Design –Master test plan, types	Maintenance Process
S-12	SLO-1	Configuration management	Concurrent Engineering in Software Design	Pair Programming	Test Case Management	life cycle
	SLO-2	Configuration management	Concurrent Engineering in Software Design	Test-Driven Development	Test Case Management	Software Release

S-13	SLO-1	Project Planning – WBC, planning,	Design Life-Cycle Management	Configuration Management	Test Case Reporting	Software Maintenance
	SLO-2	scope, risk	Design Life-Cycle Management	Software Construction Artifacts	Test Case Reporting	Software Release, Software Maintenance
S 14-15	SLO-1	Lab 3:Identify the Requirements, System Requirements, Functional Requirements, Non-Functional Requirements	Lab 6:Design a System Architecture, Use Case Diagram, ER Diagram (Database), DFD Diagram (process) (Upto Level 1), Class Diagram (Applied For OOPS based Project), Collaboration Diagram (Applied For OOPS based Project) (Software – Rational Rose)	Lab 9:Module Implementation, Scrum Master to Induce New requirements in Agile Development	Lab 12:Master Test Plan, Test Case Design (Phase 1)	Lab 15: Project Demo and Report Submission with the team
	SLO-2					

Learning Resources		
	1. Roger S. Pressman, Software Engineering – A Practitioner Approach, 6th ed., McGraw Hill, 2005	5. Ashfaque Ahmed, Software Project Management: a process-driven approach, Boca Raton, Fla: CRC Press, 2012
	2. Ian Sommerville, Software Engineering, 8th ed., Pearson Education, 2010	6. Walker Royce, Software Project Management, Pearson Education, 1999
	3. Rajib Mall, Fundamentals of Software Engineering, 4th ed., PHI Learning Private Limited, 2014	7. Jim Smith Agile Project Management: Creating Innovative Products,Pearson 2008
	4. Ramesh, Gopalaswamy, Managing Global Projects, Tata McGraw Hill, 2005	

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(5%)	Practice(5%)	Theory(7.5%)	Practice(7.5%)	Theory(7.5%)	Practice(7.5 %)	Theory(5%)	Practice(5%)	Theory(25%)	Practice(25 %)
Level 1	Remember	40%	-	20%	-	15%	-	-	-	15%	-
Level 2	Understand	30 %	-	40%	-	25%	-	-	20%	20%	-
Level 3	Apply	30 %	30 %	20%	30%	40%	20%	30%	20%	45%	30%
Level 4	Analyze	-	40 %	20%	40%	20%	20%	40%	30%	20%	35%
Level 5	Evaluate	-	30 %	-	30%	-	30%	30%	30%	-	35%
Level 6	Create	-	-	-	-	-	30%	-	-	-	-
	Total	100 %	100%	100 %	100%	100 %	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. Mr. Girish Raghavan, Wipro Technologies	***1. Dr. LathaParthiban, Pondicherry University, lathaparthiban@yahoo.com***	***1. Mrs. Sasi Rekha Sankar, SRMIST***
2. Dr.Mariappan Vaithilingam, *Amazon, Bangalore*	***2. V. Masilamani. IIITDM, masila@iiitdm.ac.in***	***2. Dr. T.S.Shiny Angel, SRMIST***
		3. Mr.N.Arivazhagan, SRMIST
		4. Mrs K.R.Jansi, SRMIST

Course Code	18CSC207J	Course Name	ADVANCED PROGRAMMING PRACTICE	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 Objective:	*The purpose of learning this course is to apply:*
1	*Structured, Procedural and Object-oriented programming paradigm*
2	*Event driven, Declarative and imperative programming paradigm*
3	*Functional, Parallel, and Concurrent Programming paradigm*
4	*Logic, Dependent type and Network programming paradigm*
5	*Symbolic, Automata based and Graphical User Interface programming paradigm*
6	*Problem solving skills using appropriate programming paradigms*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	**Learning**			**Program Learning Outcomes (PLO)**												Program Specific Output (PSO)		
		1-6			1	2	3	4	5	6	7	8	9	10	11	12			
		Level of Thinking	Expected Proficiency	Expected Attainment	Engineering	Problem Analysis	Design &	Analysis, Design,	Modern Tool Usage	Society & Culture	Environment &	Ethics	Individual & Team	Communication	Project Mgt. &	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CO-1:	*Devise solutions using structure, procedure and object-oriented programming paradigm*	*3*	*70*	*75*	*3*	*3*	*3*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*3*	*-*	*-*	*3*
CO-2:	*Determine the typeof paradigm that is used for solving a problem andapply declarative, imperative or event driven programming*	*3*	*70*	*75*	*3*	*2*	*2*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*3*	*-*	*-*	*3*
CO-3:	*Devise solutions using functional, parallel and concurrent programming paradigm*	*4*	*70*	*75*	*3*	*2*	*2*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*3*	*-*	*-*	*3*
CO-4:	*Express proficiency in usage logic, dependent type and network programming paradigms for problem solving*	*4*	*70*	*75*	*3*	*2*	*2*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*3*	*-*	*-*	*3*
CO-5:	*Device solutions using symbolic, automata based and graphical user interface programming paradigms*	*3*	*70*	*75*	*3*	*2*	*2*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*3*	*-*	*-*	*3*
CO-6:	*Device real-time applicationsby discovering appropriate programming paradigms for solving problems*	*5*	*70*	*75*	*3*	*3*	*3*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*3*	*-*	*-*	*-*

Duration (hour)		**15**	**15**	**15**	**15**	**15**
S-1	**SLO-1**	*Structured Programming Paradigm*	*Event Driven Programming Paradigm*	*Parallel Programming Paradigm*	*Logic Programming Paradigm*	*Symbolic Programming Paradigm*
	SLO-2	*Programming Language Theory*	*Event Object, handler, bind*	*Multi-threading, Multi-Processing*	*First-class function, Higher-order function, Pure functions, Recursion*	*Symbolic Maths, algebraic manipulations, limits, differentiation, integration, series*
S-2	**SLO-1**	*Bohm-Jacopini structured program theorem*	*Keypress events, Mouse events*	*Serial Processing, Parallel Processing*	*Packages: Kanren, SymPy*	*SymPy usage for symbolic maths*
	SLO-2	*Sequence, selection, decision, iteration, recursion*	*Automatic events from a timer*	*Multiprocessing module in Python*	*PySWIP, PyDatalog*	*Equation Solving, Matrices*
S-3	**SLO-1**	*Other languages: C, C++, Java, C#, Ruby*	*Other languages: Algol, Javascript, Elm*	*Process class, Pool class*	*Other languages: Prolog, ROOP, Janus*	*Other languages: Aurora, LISP, Wolfram*
	SLO-2	*Demo: Structured Programing in Python*	*Demo: Event Driven Programming in Python*	*Demo: Parallel Programming in Python*	*Demo: Logic Programming in Python*	*Demo: Symbolic Programming in Python*
S 4-5	**SLO-1** / **SLO-2**	*Lab 1: Structured Programming*	*Lab 4: Event Driven Programming*	*Lab 7: Parallel Programming*	*Lab 10: Logic Programming*	*Lab 13: Symbolic Programming*
S-6	**SLO-1**	*Procedural Programming Paradigm*	*Declarative Programming Paradigm*	*Concurrent Programming Paradigm*	*Dependent Type Programming Paradigm*	*Automata Based Programming Paradigm*
	SLO-2	*Routines, Subroutines, functions*	*Sets of declarative statements*	*Parallel Vs Concurrent Programming*	*Logic Quantifier: for all, there exists*	*Finite State Machine, deterministic finite automation (dfa), nfa*
S-7	**SLO-1**	*Using Functions in Python*	*Object attribute, Binding behavior*	*threading, multiprocessing*	*Dependent functions, dependent pairs*	*State transitions using python-automaton*

	SLO-2	*logical view, control flow of procedural programming in various aspects*	*Creating Events without describing flow*	*concurrent.futures, gevent, greenlets, celery*	*Relation between data and its computation*	*Initial state, destination state, event (transition)*
S-8	SLO-1	*Other languages: Bliss, ChucK, Matlab*	*Other languages: Prolog, Z3, LINQ, SQL*	*Other languages: ANI, Plaid*	*Other Languages: Idris, Agda, Coq*	*Other languages: Forth, Ragel, SCXML*
	SLO-2	*Demo: creating routines and subroutines using functions in Python*	*Demo: Declarative Programming in Python*	*Demo:Concurrent Programming in Python*	*Demo:Dependent Type Programming in Python*	*Demo: Automata Based Programming in Python*
S 9-10	SLO-1	*Lab 2: Procedural Programming*	*Lab 5: Declarative Programming*	*Lab 8: Concurrent Programming*	*Lab 11: Dependent Type Programming*	*Lab 14: Automata Programming*
	SLO-2					
S-11	SLO-1	*Object Oriented Programming Paradigm*	*Imperative Programming Paradigm*	*Functional Programming Paradigm*	*Network Programming Paradigm*	*GUI Programming Paradigm*
	SLO-2	*Class, Objects, Instances, Methods*	*Program State, Instructions to change the program state*	*Sequence of Commands*	*Socket Programming: TCP & UDP Connection oriented, connectionless*	*Graphical User Interface (GUI)*
S-12	SLO-1	*Encapsulation, Data Abstraction*	*Combining Algorithms and Data Structures*	*map(), reduce(), filter(), lambda*	*Sock_Stream, Sock_Dgram, socket(), bind(), recvfrom(), sendto(), listen()*	*Tkinter, WxPython, JPython*
	SLO-2	*Polymorphism, Inheritance*	*Imperative Vs Declarative Programming*	*partial, functools*	*Server-Client; send(), recv(), connect(), accept(), read(), write(), close()*	*WxWidgets, PyQT5*
S-13	SLO-1	*Constructor, Destructor*	*Other languages: PHP, Ruby, Perl, Swift*	*Other languages:F#, Clojure, Haskell*	*Other languages: PowerShell, Bash, TCL*	*Other languages: GTK, java-gnome*
	SLO-2	*Example Languages: BETA, Cecil, Lava Demo: OOP in Python*	*Demo: Imperative Programming in Python*	*Demo: Functional Programming in Python*	*Demo: Socket Programming in Python*	*Demo: GUI Programming in Python*
S 14-15	SLO-1	*Lab 3: Object Oriented Programming*	*Lab 6: Imperative Programming*	*Lab 9: Functional Programming*	*Lab 12: Network Programming*	*Lab 15: GUI Programming*
	SLO-2					

Learning Resources	1. *Elad Shalom, A Review of Programming Paradigms throughout the History: With a suggestion Toward a Future Approach, Kindle Edition, 2018* 2. *John Goerzen, Brandon Rhodes, Foundations of Python Network Programming: The comprehensive guide to building network applications with Python, 2nd ed., Kindle Edition, 2010* 3. *Elliot Forbes, Learning Concurrency in Python: Build highly efficient, robust and concurrent applications, Kindle Edition, 2017*	4. *Amit Saha, Doing Math with Python: Use Programming to Explore Algebra, Statistics, Calculus and More, Kindle Edition, 2015* 5. *Alan D Moore, Python GUI Programming with Tkinter: Develop responsive and powerful GUI applications with Tkinter, Kindle Edition, 2018* 6. *https://www.scipy-lectures.org/*

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 (5%)	Practice (5%)	Theory (7.5%)	Practice (7.5%)	Theory (7.5%)	Practice (7.5%)	Theory (5%)	Practice (5%)	Theory (25%)	Practice (25%)
Level 1	Remember	20%		15%		15%				15%	
Level 2	Understand	20%		25%		25%				20%	
Level 3	Apply	25%	30%	35%	35%	30%	40%	25%	20%	35%	30%
Level 4	Analyze	15%	40%	15%	35%	20%	30%	30%	50%	20%	35%
Level 5	Evaluate		30%		30%		30%	25%	30%		35%
Level 6	Create	20%		10%		10%		20%		10%	
	Total	100 %	100 %	100 %	100 %	100 %	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. Mr. Sagar Sahani, Amadeus Software Labs, Bangalore, hello.sagarsahni@gmail.com	*1. Dr. Rajeev Sukumaran, IIT Madras, rajeev@wmail.iitm.ac.in*	***1.**Dr. R. Annie Uthra, SRMIST*
2. Mr. Janmajay Singh, Fuji Xerox R&D, Japan, janmajaysingh14@gmail.com	***2.**Prof. R. Golda Brunet, GCE, goldabrunet@gcessalem.edu.in*	*2. Mr. C. Arun, SRMIST*
		3. Ms. K. Sornalakshmi, SRMIST

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY
LEARN · LEAP · LEAD

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 Objective:	*The purpose of learning this course is to:*
1	*Identify and apply basic discrete mathematical fundamentals in regular language and automata creation*
2	*Develop context-free grammar in normal form*
3	*Design push-down automata from a context-free grammar*
4	*Design a Turing machine from recursively enumerable language*
5	*Identify computational complexity of different languages mathematically*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Learning 1-6: Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Program Outcomes (PO) 1: Engineering Knowledge	2: Problem Analysis	3: Design & Development	4: Analysis, Design, Research	5: Modern Tool Usage	6: Society & Culture	7: Environment & Sustainability	8: Ethics	9: Individual & Team Work	10: Communication	11: Project Mgt. & Finance	12: Life Long Learning	PSO: PSO - 1	PSO - 2	PSO – 3
CO-1 :	*Express the fundamentals of regular languages and finite automata.*	3	60	60	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO-2 :	*Construct context-free Grammar and simplify using normal forms*	3	60	60	-	3	2	-	-	-	-	-	-	-	-	-	-	-	3
CO-3 :	*Design push-down automata, and Turing recognizable languages.*	3	60	60	-	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO-4 :	*Design the computational and acceptor machines using FA, PDA and Turing machines*	3	60	60	-	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO-5 :	*Demonstrate the Decidability or Undecidability of various problems*	3	60	60	-		3	1	-	-	-	-	-	-	-	-	2	-	3

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	20 %	-	20 %	-	20 %	-	20 %	-	20 %	-
Level 2	Understand	20 %	-	20 %	-	20 %	-	20 %	-	20 %	-
Level 3	Apply	60 %	-	60 %	-	60 %	-	60 %	-	60 %	-
Level 4	Analyze	-	-	-	-	-	-	-	-	-	-
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.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		Dr.R.AnnieUthra
		Dr.Jeyasudha
		Dr R I Minu

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	Computing Technologies	Data Book / Codes/Standards	Nil		

Course Objectives	The purpose of learning this course is to:
1 :	Describe the functionality of network layer protocols and transport layer protocols in the data communication
2 :	Develop the client server programming to connect with various applications
3 :	Describe the functionality of protocols used in the application layer
4 :	Implement the IPv6 addressing in a network
5 :	Understand the technologies used in telephone network, cable network, ATM network and PPP

Course Outcomes (CO):	At the end of this course, learners will be able to:	Learning 1-6			Program Outcomes (PO)												PSO		
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	1 Engineering Knowledge	2 Problem Analysis	3 Design & Development	4 Analysis, Design, Research	5 Modern Tool Usage	6 Society & Culture	7 Environment & Sustainability	8 Ethics	9 Individual & Team Work	10 Communication	11 Project Mgt. & Finance	12 Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CO-1 :	Identify the protocols used in network layer and transport layer and their functionality	6	70	60	3	-	-	-	-	-	-	-	-	-	-	-	-	-	2
CO-2 :	Implement the socket programming to connect the server and client for data communication	6	70	60	-	-	3	-	1	-	-	-	-	-	-	-	-	-	2
CO-3 :	Identify the protocols used in application layer for file transfer, mail transfer and www	6	70	60	3	-	1	-	-	-	-	-	-	-	-	-	-	-	2
CO-4 :	Analyze and compare the IPv4 and IPv6 protocols	6	70	60		1	1	3	-	-	-	-	-	-	-	-	-	-	2
CO-5 :	Identify the technologies and its functionality used in telephone network, cable network, ATM network and PPP	6	70	60	3	-	-	-	-	-	-	-	-	-	-	-	-	-	2

Duration (hour)		15	15	15	15	15
S-1	SLO-1	IP header	Byte ordering	DNS	IPV6 Overview	DSL
	SLO-2	IP fragmentation	Byte ordering conversion functions	DNS in the Internet,	IPV6 Features	Other DSL Technology
S-2	SLO-1	ARP	System calls	DNS Resolution	IPV6 Addressing Modes	DSL Benefits
	SLO-2	RARP	Sockets	DNS Messages	IPV6 Address Types	Cable Technology
S-3	SLO-1	ICMP –introduction	System calls used with Sockets	TELNET	Introduction	Compare DSL Vs Cable
	SLO-2	ICMP-Messages	Iterative and concurrent server	*SSH*	Address Space Allocation	Frame Relay, VPN
S 4-5	SLO-1 SLO-2	**Study of necessary header files with respect to socket programming.**	**UDP Echo Client Server Communication**	**Full Duplex Chat Using TCP/IP**	**ARP implementation Using UDP**	**Implementation of VPN**
S-6	SLO-1	Debugging tools	Socket Interface	FTP	Global Unicast Addresses	ATM Introduction
	SLO-2	ICMP package	Structure and Functions of Socket	TFTP	Auto configuration	ATM Cell Format
S-7	SLO-1	UDP Datagram	Remote Procedure Call	WWW Architecture	Renumbering	ATM Layer
	SLO-2	UDP characteristics	RPC Model, Features	WWW Documents	IPV6 Routing Protocols	AAL Layer
S-8	SLO-1	TCP Header	TCP Client Server Program	HTTP	Introduction	ATM Application
	SLO-2	TCP connection establishment process	Input, Output Processing Module	HTTP Request and Reply	IPV6 Packet Format	PPP
S 9-10	SLO-1 SLO-2	**Study of Basic Functions of Socket Programming**	**Concurrent TCP/IP Day-Time Server**	**Implementation of File Transfer Protocol**	**Study of IPV6 Addressing & Subnetting**	**Communication Using HDLC**
S-11	SLO-1	TCP Error Control	UDP Client Server Program	DHCP Operation	Comparison between IPV4 and IPV6 Header	PPP Services, Components
	SLO-2	TCP Congestion Control	UDP Control block table & Module	DHCP Configuration	IPV4 to IPV6 Tunneling	PPP frame and byte stuffing
S-12	SLO-1	TCP Flow Control	UDP Input & Output Module	*SMTP*	IPV4 to IPV6 Translation Techniques	HDLC
	SLO-2	*Multicasting*	SCTP Sockets	*POP3*	*NAT Protocol Translation*	HDLC Transfer Modes, Frame
S-13	SLO-1	*Multicasting and Multicast Routing Protocol*	SCTP Services and Features, Packet Format	*IMAP*	*IPV6 Mobility*	*Types of HDLC Frame*

	SLO-2	*Stream Control Transmission Protocol*	SCTP Client/Server	*MIME*	*Protocols Changed to Support IPV6*	MPLS
S 14-15	**SLO-1**	***Simple TCP/IP Client Server Communication***	**Half Duplex Chat Using TCP/IP**	***Remote Command Execution Using UDP***	***Implementation of NAT***	**Communication Using PPP**
	SLO-2					

Learning Resources	1. *Behrouz A. Forouzan, "TCP IP Protocol Suite " 4th edition, 2010, McGraw-HillISBN: 0073376043* 2. *Douglas E. Comer, Internetworking with TCP/IP, Principles, protocols, and architecture,Vol 1 5th Edition,2006 ISBN: 0131876716, ISBN: 978-0131876712*	3. *Richard Stevens, Unix Network Programming, vol.1, 3rd edition, 2003, McGraw-HillISBN 0-07-246060-1*

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	*10 %*	5%	*10 %*	*5%*	*10 %*	*5%*	*5 %*	*5%*	*5 %*	*5%*
Level 2	Understand	10%	10%	*10 %*	10%	10%	10%	10%	10%	10%	10%
Level 3	Apply	*15 %*	*10 %*	*10 %*	*15%*	*10 %*	*10%*	*15 %*	*10%*	*20 %*	*10%*
Level 4	Analyze	15%	5%	*10 %*	10%	10%	10%	10%	10%	10%	10%
Level 5	Evaluate		*15%*	*10 %*	*5%*	10%	*10%*	*10 %*	*5%*	*5 %*	*10%*
Level 6	Create		5%		5%		5%		5%		5%
	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.Thamaraiselvam.S, Zoho Corporation. thamaraiselvams@gmail.com	1.Dr.Uma,Anna University ,umaramesh@auist.net	1.Dr.K.Venkatesh,SRMIST,2.Dr.G.Usha,SRMIST
2.Mithun,Cognizant, Mithun.SS@cognizant.com	2. Dr.KunvarSingh, NIT Trichy,kunwar@nitt.edu	3.Dr.J.Kalaivani,SRMIST,4.Mr.GodwinPon,SRMIST

Course Code	18CSC303J	Course Name	DATABASE MANAGEMENT SYSTEMS	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 Objectives:	The purpose of learning this course is to:
1		Understand the fundamentals of Database Management Systems, Architecture and Languages
2		Conceive the database design process through ER Model and Relational Model
3		Design Logical Database Schema and mapping it to implementation level schema through Database Language Features
4		Familiarize queries using Structure Query Language (SQL) and PL/SQL
5		Familiarize the Improvement of the database design using normalization criteria and optimize queries
6		Understand the practical problems of concurrency control and gain knowledge about failures and recovery

	Course Outcomes (CO):	At the end of this course, learners will be able to:	Learning 1 - 6: Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Program Outcomes (PO) 1	2	3	4	5	6	7	8	9	100	11	12	PSO 1	PSO 2	PSO 3
						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			
CO1 :		Define the fundamentals of Database Management Systems, Architecture and Languages.	5	60	70	3	2	2	-	-	-	-	-	-	-	-	-	2	2	-
CO2 :		Demonstrate ER Model and Relational Model in database design process.	5	60	70	3	2	2	-	-	-	-	-	-	-	-	-	2	2	-
CO3 :		Apply Database Design Languages for mapping Logical Database Schema to Implementation level Schema	5	60	70	3	3	3	-	-	-	-	-	-	-	-	-	2	2	-
CO4 :		Familiarize the Improvement of the Database design using Normalization criteria and optimize queries	5	60	70	3	3	3	2	-	-	-	-	-	-	-	-	2	2	-
CO5 :		Implement Serialization, Concurrency Control, Deadlock Recovery and Atomicity in Database Management System	5	60	70	3	2	2	-	-	-	-	-	-	-	-	-	2	2	-

Duration (hour)		15	15	15	15	15
S-1	SLO-1	What is Database Management System	Database Design	Basics of SQL-DDL,DML,DCL,TCL	Relational Algebra – Fundamental Operators and syntax, relational algebra queries, Tuple relational calculus	Transaction concepts, properties of transactions,
	SLO-2	Advantage of DBMS over File Processing System	Design process	Structure Creation, alternation		
S-2	SLO-1	Introduction and applications of DBMS	Entity Relation Model	Defining Constraints-Primary Key, Foreign Key, Unique, not null, check, IN operator		Serial izability of transactions,
	SLO-2	Purpose of database system				testing for serial inability, System recovery,
S-3	SLO-1	Views of data	ER diagram	Functions-aggregation functions	Pitfalls in Relational database, Decomposing bad schema	Concurrency Control
	SLO-2			Built-in Functions-numeric, date, string functions, string functions, Set operations,	Functional Dependency – definition, trivial and non-trivial FD	
S 4-5	SLO-1	Lab 1: SQL Data Definition Language Commands on sample exercise * The abstract of the project to construct database must be framed	Lab4 Inbuilt functions in SQL on sample Exercise.	Lab 7 : Join Queries on sample exercise. * Frame and execute the appropriate DDL,DML,DCL,TCL for the project	Lab10: PL/SQL Procedures on sample exercise. * Frame and execute the appropriate Join Queries for the project	Lab 13: PL/SQL Exception Handling * Frame and execute the appropriate PL/SQL Procedures and Functions for the project
	SLO-2					
S-6	SLO-1	Database system Architecture	Keys , Attributes and Constraints	Sub Queries, correlated sub queries	closure of FD set , closure of attributes	Two- Phase Commit protocol, Recovery and Atomicity
	SLO-2				irreducible set of FD	
S-7	SLO-1	Data Independence	Mapping Cardinality	Nested Queries, Views and its Types	Normalization – 1Nf, 2NF, 3NF,	Log-based recovery
	SLO-2					
S-8	SLO-1	The evolution of Data Models	Extended ER - Generalization,	Transaction Control Commands	Decomposition using FD- dependency	concurrent executions of transactions and
	SLO-2		Specialization and Aggregation	Commit, Rollback, Save point	preservation,	related problems
S 9-10	SLO-1	Lab 2: SQL Data Manipulation Language Commands * Identification of project Modules and functionality	Lab 5: Construct a ER Model for the application to be constructed to a Database	Lab 8: Set Operators & Views. * Frame and execute the appropriate In-Built functions for the project	Lab 11: PL/SQL Functions * Frame and execute the appropriate Set Operators & Views for the project	Lab 14: PL/SQL Trigger * Frame and execute the appropriate PL/SQL Cursors and Exceptional Handling for the project
	SLO-2					
S-11	SLO-1	Degrees of Data Abstraction	ER Diagram Issues	PL/SQL Concepts- Cursors	BCNF	Locking mechanism, solution to concurrency related problems
	SLO-2		Weak Entity			

S-12	SLO-1	*Database Users and DBA*	*Relational Model*	*Stored Procedure, Functions Triggers and Exceptional Handling*	*Multi- valued dependency,*	*Deadlock*
	SLO-2				*4NF*	
S-13	SLO-1	*Database Languages*	*Conversion of ER to Relational Table*	*Query Processing*	*Join dependency and 5NF*	*two-phase locking protocol, Isolation, Intent locking*
	SLO-2					
S 14-15	SLO-1	*Lab 3: SQL Data Control Language Commands and Transaction control commands to the sample exercises*	*Lab 6: Nested Queries on sample exercise*	*Lab9: PL/SQL Conditional and Iterative Statements*	*Lab 12: PL/SQL Cursors*	*Lab 15 : * Frame and execute the appropriate PL/SQL Cursors and Exceptional Handling for the project*
	SLO-2	** Identify the issues that can arise in a business perspective for the application*	** Construction of Relational Table from the ER Diagram*	** Frame and execute the appropriate Nested Queries for the project*	** Frame and execute the appropriate PL/SQL Conditional and Iterative Statements for the project*	** Demo of the project*

Learning Resources	1. *Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Database System Conceptsll, Sixth Edition, Tata McGraw Hill,2011.* 2. *Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systemsll, Sixth Edition, Pearson Education,2011.* 3. *CJ Date,A Kannan,S Swamynathan, An Introduction to Database Systems, Eight Edition, Pearson Education,2006.* 4. *Rajesh Narang, Database Management Systems, 2nd ed., PHI Learning Private Limited,2011.*	4. *Martin Gruber, Understanding SQL, Sybex,1990* 5. *Sharad Maheshwari,Introduction to SQLandPL/SQL,2ded.,LaxmiPublications,2016.* 6. *RaghuramaKrishnan,Johannes Gehrke,Database Management Systems,3rdEdition,McGrawHill Education,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 (5%)	Practice (5%)	Theory (7.5%)	Practice (7.5%)	Theory (7.5%)	Practice (7.5%)	Theory (5%)	Practice (5%)	Theory (25%)	Practice (25%)
Level 1	Remember	20%		15%		15%				15%	
Level 2	Understand	20%		25%		25%		25%		20%	
Level 3	Apply	45%	30%	40%	35%	40%	40%	20%	20%	45%	30%
Level 4	Analyze	15%	40%	20%	35%	20%	30%	20%	50%	20%	35%
Level 5	Evaluate		30%		30%		30%	25%	30%		35%
Level 6	Create										
	Total	100 %	100 %	100 %	100 %	100 %	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. Dr.Mariappan Vaithilingam, Engineering Leader Amazon, dr.v.m@ieee.org		*1. Ms. Sasi Rekha Sankar SRMIST*
2. Mr. Badinath, SDET, Amzon, sbadhrinath@gmail.com		*2. Dr. M. Eliazer, SRMIST*
		3. Mrs. Hemavathy, SRMIST

Course Code	18CSC304J	Course Name	COMPILER DESIGN	Course Category	C	Professional Core	L	T	P	C
							3	0	2	4

Pre-requisite Courses	18CSC301T	Co-requisite Courses	Nil	Progressive Courses	
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards		Nil	

Course Objectives:	The purpose of learning this course is to:	Learning		
		1	2	3
1	Identify and use fundamental mathematics principles for the Design of Compilers	Bloom's Level (1-6)	Expected Proficiency (%)	Expected Attainment (%)
2	Enable the students to find Context free Grammar and to learn the various types of top down parsing methods			
3	Learn the various types of Bottom up parsing methods as SLR,CLR and LALR			
4	Understand intermediate code generation and run-time environment			
5	Learn to implement Code Generator and understand different Code optimization technique			

Course Outcomes (CO):	At the end of this course, learners will be able to:	Learning		
CO-1 :	Utilize the mathematics and engineering principles for the Design of Compilers	3	60	70
CO-2 :	Construct Context free Grammar and simplify using normal forms and parsing the sentences in top down parser	5	60	70
CO-3 :	Acquire knowledge of Syntax Analyzer for bottom up parsing	5	60	70
CO-4 :	Gain knowledge to translate a system into various intermediate codes	3	60	70
CO-5 :	Analyze the methods of implementing a Code Generator for compilers and to design the methods of developing a Code Optimizer	4	60	70

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

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Compilers – Analysis of the source program	Syntax Analysis Definition - Role of parser	Bottom Up Parsing	Intermediate Code Generation	Code optimization
	SLO-2	Phases of a compiler – Cousins of the Compiler	Lexical versus Syntactic Analysis	Reductions	Intermediate Languages - prefix - postfix	Introduction– Principal Sources of Optimization
S-2	SLO-1	Grouping of Phases – Compiler construction tools	Representative Grammars	Handle Pruning	Quadruple - triple - indirect triples Representation	Function Preserving Transformation
	SLO-2	Lexical Analysis – Role of Lexical Analyzer	Syntax Error Handling	Shift Reduce Parsing	Syntax tree- Evaluation of expression - three-address code	Loop Optimization
S-3	SLO-1	Input Buffering	Elimination of Ambiguity, Left Recursion	Problems related to Shift Reduce Parsing	Synthesized attributes – Inherited attributes	Optimization of basic Blocks
	SLO-2	Specification of Tokens	Left Factoring	Conflicts During Shift Reduce Parsing	Intermediate languages – Declarations	Building Expression of DAG
S 4-5	SLO-1	Lab 1 - Implementation of Lexical Analyzer	Lab 4Elimation of Ambiguity, Left Recursion and Left Factoring	Lab 7 - Shift Reduce Parsing	Lab 10-Intermediate code generation – Postfix, Prefix	Lab 13 Implementation of DAG
	SLO-2					
S-6	SLO-1	Finite automation - deterministic	Top down parsing	LR Parsers- Why LR Parsers	Assignment Statements	Peephole Optimization
	SLO-2	Finite automation - non deterministic	Recursive Descent Parsing, back tracking	Items and LR(0) Automaton, Closure of Item Sets,	Boolean Expressions, Case Statements	Basic Blocks, Flow Graphs
S-7	SLO-1	Transition Tables	Computation of FIRST	LR Parsing Algorithm	Back patching – Procedure calls	Next -Use Information

	SLO-2	Acceptance of Input Strings by Automata	Problems related to FIRST	Operator Precedence Parser Computation of LEADING	Code Generation	Introduction to Global Data Flow Analysis
S-8	SLO-1	State Diagrams and Regular Expressions	Computation of FOLLOW	Computation of TRAILING	Issues in the design of code generator	Computation of gen and kill
	SLO-2	Conversion of regular expression to NFA – Thompson's	Problems related to FOLLOW	Problems related to LEADING AND TRAILING	The target machine – Runtime Storage management	Computation of in and out
S 9-10	SLO-1 SLO-2	Lab 2 conversion from Regular Expression to NFA	Lab 5 -FIRST AND FOLLOW computation	Lab 8- Computation of LEADING AND TRAILING	Lab 11 Intermediate code generation – Quadruple, Triple, Indirect triple	Lab 14 : Implementation of Global Data Flow Analysis
S-11	SLO-1	Conversion of NFA to DFA	Construction of a predictive parsing table	SLR Grammars	A simple Code generator	Parameter Passing.
	SLO-2	Simulation of an NFA	Predictive Parsers LL(1) Grammars	SLR Parsing Tables	Code Generation Algorithm	Runtime Environments
S-12	SLO-1	Converting Regular expression directly to DFA	Transition Diagrams for Predictive Parsers	Problems related to SLR	Register and Address Descriptors	Source Language issues
	SLO-2	Minimization of DFA	Error Recovery in Predictive Parsing	Construction of Canonical LR(1) and LALR	Generating Code of Assignment Statements	Storage Organization
S-13	SLO-1	Minimization of NFA	Predictive Parsing Algorithm	Construction of LALR	Cross Compiler – T diagrams	Activation Records
	SLO-2	Design of lexical analysis (LEX)	Non Recursive Predictive Parser	Problems related to Canonical LR(1) and LALR Parsing Table	Issues in Cross compilers	Storage Allocation strategies
S 14-15	SLO-1 SLO-2	Lab 3 Conversion from NFA to DFA	Lab 6 Predictive Parsing Table	Lab9 Computation of LR(0) items	Lab 12 : A simple code Generator	Lab 15: Implement any one storage allocation strategies(heap, stack, static)

Learning Resources	1. AlfredVAho,JefferyDUllman,RaviSethi,"Compilers,Principlestechniquesandtools",Pearson Education2011 2. S.GodfreyWinster,S.ArunaDevi,R.Sujatha,"CompilerDesign",YesdeePublishingPvt.Ltd,2016 3. WilliamM.WaiteandGerhardGoos.CompilerConstruction.Springer-Verlag,New York,2013.	4. K.Muneeswaran,,"CompilerDesign",OxfordHigherEducation,Fourthedition2015 5. DavidGalles,"ModernCompilerDesign",PearsonEducation,Reprint2012. 6. RaghavanV.,"PrinciplesofCompilerDesign",TataMcGrawHillEducationPvt.Ltd.,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	10 %	5%	10 %	5%	10 %	5%	5 %	5%	5 %	5%
Level 2	Understand	15%	10%	10 %	10%	10%	10%	10%	10%	10%	10%
Level 3	Apply	25%	10 %	10 %	15%	15 %	10%	15 %	10%	20 %	10%
Level 4	Analyze		5%	10 %	10%	15%	10%	10%	10%	10%	10%
Level 5	Evaluate		20%	10 %	10%		15%	10 %	10%	5 %	20%
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.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		1. Dr.R.Jeya
		2. Mrs.J. Jeyasudha

Course Code	18CSC305J	Course Name	ARTIFICIAL INTELLIGENCE	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 Objectives	*The purpose of learning this course is to:*
1	*Gain knowledge for building intelligent agents and in problem formulation*
2	*Understand the search technique procedures applied to real world problems*
3	*Understand the types of logic and knowledge representation schemes*
4	*Acquire knowledge in planning and learning algorithms*
5	*Gain knowledge in Expert systems and advances in Artificial Intelligence*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PO)												PSO		
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12			
		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
CO-1 :	*Formulate a problem and build intelligent agents*	*4*	*60*	*70*	*3*	*2*	*3*	-	-	-	-	-	-	-	-	-	*1*	*1*	*1*
CO-2 :	*Apply appropriate searching techniques to solve a real-world problem*	*5*	*60*	*70*	*3*	*2*	*3*	-	-	-	-	-	-	-	-	-	*2*	*1*	*2*
CO-3 :	*Analyze the problem and infer new knowledge using suitable knowledge representation schemes*	*5*	*60*	*70*	*2*	*3*	*3*	-	-	-	-	-	-	-	-	-	*2*	*1*	*2*
CO-4 :	*Prepare a plan and solve real world problems using learning algorithms*	*5*	*60*	*70*	*2*	*3*	*2*	-	-	-	-	-	-	-	-	-	*2*	*2*	*3*
CO-5 :	*Design an expert system and implement advanced techniques in Artificial Intelligence agents.*	*5*	*60*	*70*	*2*	*3*	*3*	*2*	-	-	-	-	-	-	-		*3*	*2*	*3*

Duration (hour)		15	15	15	15	15
S-1	SLO-1	*Introduction to AI-AI techniques*	*Searching techniques- Uniformed search- General search Algorithm*	*Knowledge and reasoning-Approaches and issues of knowledge reasoning*	*Planning- Planning problems, Simple planning agent*	*Expert system-Architecture*
	SLO-2	*Problem solving with AI*	*Uniformed search Methods-Breadth first search*	*Knowledge base agents-Logic Basics*	*Planning languages*	*Pros and Cons of expert system*
S-2	SLO-1	*AI Models, Data acquisition and learning aspects in AI*	*Uniformed search Methods-Depth first search*	*Logic-Propositional logic-syntax ,semantics and inferences*	*Blocks world ,Goal stack planning*	*Rule based systems*
	SLO-2	*Problem solving- Problem solving process, Formulating problems*	*Uniformed search Methods-Depth limited search*	*Propositional logic- Reasoning patterns*	*Mean Ends Analysis*	*Frame based expert system*
S-3	SLO-1	*Problem types and characteristics*	*Uniformed search Methods- Iterative Deepening search*	*Predicate logic – Syntax and semantics, instance and is relationship*	*Non-linear Planning*	*Case study*
	SLO-2	*Problem space and search*	*Bi-directional search*	*Unification and Resolution*	*Conditional planning, Reactive planning*	*Case study*
S 4-5	SLO-1	*Lab 1: Implementation of toy problems*	*Lab4: Implementation and Analysis of DFS and BFS for an application*	*Lab 7: Implementation of unification and resolution for real world problems.*	*Lab 10 :Implementation of block world problem*	*Natural language processing-Levels of NLP*
	SLO-2					
S-6	SLO-1	*Intelligent agent*	*Informed search- Generate and test, Best First search*	*Knowledge representation using rules*	*Learning- Machine learning*	*Syntactic and Semantic Analysis*
	SLO-2	*Rationality and Rational agent with performance measures*	*Informed search-A* Algorithm*	*Knowledge representation using semantic nets*	*Goals and Challenges of machine learning*	*Information retrieval*
S-7	SLO-1	*Flexibility and Intelligent agents*	*AO* research*	*Knowledge representation using frames*	*Learning concepts, models*	*Information Extraction*
	SLO-2	*Task environment and its properties*	*Local search Algorithms-Hill Climbing, Simulated Annealing*	*Inferences*	*Artificial neural network based learning-Back propagation*	*Machine translation*
S-8	SLO-1	*Types of agents*	*Local Beam Search*	*Uncertain Knowledge and reasoning-Methods*	*Support vector machines*	*NLP Applications*
	SLO-2	*Other aspects of agents*	*Genetic Algorithms*	*Bayesian probability and belief network*	*Reinforcement learning*	*NLP Applications*
S-9-10	SLO-1	*Lab 2: Developing agent programs for real world problems*	*Lab 5: Developing Best first search and A* Algorithm for real world problems*	*Lab 8: Implementation of knowledge representation schemes - use cases*	*Lab 11: Implementation of learning algorithms for an application*	*Lab 14:Implementation of NLP programs*
	SLO-2					

S-11	SLO-1	*Constraint satisfaction problems(CSP)*	*Adversarial search Methods-Game playing-Important concepts*	*Probabilistic reasoning*	*Adaptive learning*	*Advance topics in Artificial Intelligence- Cloud Computing and intelligent agent*
	SLO-	*Crypto arithmetic puzzles*	*Game playing and knowledge structure*	*Probabilistic reasoning over time*	*Multi agent based learning*	*Business intelligence and analytics*

	2					
S-12	SLO-1	*CSP as a search problem-constrains and representation*	*Game as a search problem-Mini max approach*	*Forward and backward reasoning*	*Ensemble learning*	*Sentiment Analysis*
	SLO-2	*CSP-Backtracking, Role of heuristic*	*Mini max Algorithm*	*Other uncertain techniques-Data mining*	*Learning for decision making*	*Deep learning Algorithms*
S-13	SLO-1	*CSP-Forward checking and constraint propagation*	*Alpha beta pruning*	*Fuzzy logic*	*Distributed learning*	*Deep learning Algorithms*
	SLO-2	*CSP-Intelligent backtracking*	*Game theory problems*	*Dempster -shafer theory*	*Speedup learning*	*Planning and logic in intelligent agents*
S 14-15	SLO-1	*Lab 3: Implementation of constraint satisfaction problems*	*Lab 6: Implementation of mini max algorithm for an application*	*Lab 9: Implementation of uncertain methods for an application*	*Lab12: Development of ensemble model for an application*	*Lab 15: Applying deep learning methods to solve an application.*
	SLO-2					

Learning Resources	1. *Parag Kulkarni, Prachi Joshi, Artificial Intelligence –Building Intelligent Systems, 1st ed., PHI learning,2015* 2. *DeepakKemhani,FirstcourseinArtificilaIntelligence,McGrawHillPvtLtd,2013* 3. *Stuart J. Russell, Peter Norwig , Artificial Intelligence –A Modern approach, 3rd Pearson Education, 2016*	4. *PrateekJoshi,ArtificialIntelligencewithPhython,1sted.,PacktPublishing,2017* 5. *DenisRothman,ArtificialIntelligencebyExample,Packt,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%)			
		Theory (5%)	Practice (5%)	Theory (7.5%)	Practice (7.5%)	Theory (7.5%)	Practice (7.5%)	Theory (5%)	Practice (5%)	Theory (25%)	Practice (25%)
Level 1	Remember	20%		15%		15%				15%	
Level 2	Understand	20%		25%		25%		35%		20%	
Level 3	Apply	35%	50%	35%	35%	35%	40%	35%	30%	35%	30%
Level 4	Analyze	25%	50%	25%	35%	25%	30%	30%	50%	30%	35%
Level 5	Evaluate				30%		30%		20%		35%
Level 6	Create										
	Total	100 %	100 %	100 %	100 %	100 %	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. Mr.Jagatheeswaran, Lead, Auxo labs jagatheeswarans.iot@auxolabs.in	*1. Dr. Chitrakala, Anna University, au.chitras@gmail.com*	*1. Dr.M.Pushpalatha, SRMIST*
		2. Dr.G..Vadivu, SRMIST
		3. Dr.C.Lakshmi, SRMIST

Course Code	18CSS201J	Course Name	ANALOG AND DIGITAL ELECTRONICS	Course Category	S	Engineering Sciences	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		

CourseOutcomes	The purpose of learning this course is to:	Learning			Program Outcomes (PO)												Program Specific Outcome (PSO)		
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12			
		Level of Thinking	Expected Proficiency (%)	Expected	Engineering	Problem Analysis	Design &	Analysis, Design,	Modern Tool	Society & Culture	Environment &	Ethics	Individual &	Communication	Project Mgt. &	Life Long			
1	Analyze the characteristics of transistor family and digital ICs																		
2	Design and implement the combinational and sequential logic circuits																		
3	Design and implement counters and registers																		
4	Acquire skills to handle packages towards simulation																		
5	Synthesize coding logic for a given application using HDL																		
Course Outcomes (CO):	*At the end of this course, learners will be able to:*																		
CO-1 :	Identify appropriate transistors and digital ICs based on the characteristics learned	4	60	70	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2 :	Analyze combinational and sequential logic circuits for any given application	5	60	70	1		2	-	-	-	-	-	-	-	-	-	-	-	2
CO-3 :	Assess right choice of gates and flip-flops for designing counters and registers	6	60	70	1	-	2		-	-	-	-	-	-	-	-	-	-	1
CO-4 :	Apply the acquired skills in package handling to realize circuits	6	60	70	-		2		1	-	-	-	-	-	-	-	-	-	-
CO-5 :	Develop coding logics using HDL for a given scenario	6	60	70	-	1	2	-	-	-	-	-	-	-	-	-	-	-	2

		Introduction to Analog electronics	Logic Families	Combinational Logic Circuits	Sequential Logic circuits	Registers & Counters
Duration (hour)		15	15	15	15	15
S-1	SLO-1	Characteristics of BJT (CB, CE and CC configurations) and DC biasing	Transistor as a Switch	Quine-McCluskey minimization technique	Sequential circuits, Latch and Flip-Flops	Registers and Types of Registers- Serial In - Serial Out, Serial In - Parallel out
	SLO-2	**BJT Uses**	Characteristics of Digital ICs	Combinational Circuits	RS Flip-Flops,	Parallel In - Serial Out, Parallel In - Parallel Out
S-2	SLO-1	Characteristics and uses of JFET (CS, Common Drain and Common Gate)	**DL, RTL**	Multiplexer	Gated Flip-Flops	Universal Shift Register
	SLO-2	Differences between BJT and JFET	DTL,TTL	Demultiplexer	Edge-triggered RS FLIP-FLOP	Applications of Shift Registers
S-3	SLO-1	Transistor Amplifier: CE amplifier	ECL	**Decoder**	Edge-triggered D FLIP-FLOPs	Synchronous Counters
	SLO-2	Transistor Amplifier: CC ,CB amplifier	IIL	**Encoder**	Edge-triggered T FLIP-FLOPs	Asynchronous Counters
S 4-5	SLO-1	Lab 1:Design and Implement Half and Full Wave Rectifiers using simulation	**Lab 4: Design and implement transistor as a switch**	Lab 7:Design and implement code converters using logic gates simulation	**Lab 10:HDL implementation of Flip-Flop**	Lab 13: Implement SISO, SIPO, PISO and PIPO shift registers using Flip- flops
	SLO-2					
S-6	SLO-1	Power Amplifiers: Different classes of Amplifiers and its operation-Class A	Characteristics and uses of MOSFET (CS, Common drain and Common gate)	Binary adder	Edge-triggered JK FLIPFLOPs	Changing the Counter Modulus
	SLO-2	Class B, AB and C	MOSFET Logic	**Binary adder as subtractor**	JK Master-slave FLIP-FLOP	Decade Counters
S-7	SLO-1	Operational Amplifiers: Ideal v/s practical Op-amp	PMOS,NMOS	**Carry look ahead adder**	Analysis of SynchronousSequential Circuit, **State Equation, State table**	Presettable counters

	SLO-2	*Performance Parameters*	***CMOS Logic***	*Decimal adder*	***State Diagram***	*Counter Design as a Synthesis problem*
S-8	SLO-1	*Applications: Peak detector, Comparator, Inverting, Non-Inverting Amplifiers*	*Propagation delay*	*Magnitude Comparator*	*Synthesis of sequential circuit using Flip-Flops*	*Seven segment Display and A Digital Clock.*
	SLO-2	*Problem solving session*	*Problem solving session*	*Problem solving session*	*Problem solving session*	*Problem solving session*
S 9-10	**SLO-1** / **SLO-2**	*Lab 2: Design and implement Schmitt trigger using Op-Amp (simulation)*	*Lab 5: Design CMOS Inverter, measure propagation delay for rising & falling edge*	*Lab 8: Design and implement using simulation the combinational circuits*	*Lab 11: Design and implement using simulation; Synchronous sequential circuits*	*Lab 14:HDL for Registers and Counters*
S-11	SLO-1	*Effect of positive and Negative Feedback Amplifiers,*	*Tristate Logic*	*Read Only Memory*	*Asynchronous sequential circuit*	*D/A Conversion*
	SLO-2	*Analysis of Practical Feedback Amplifiers*	*Tristate Logic Applications*	*Arithmetic Logic Unit*	*Transition Table*	*Types of D/A Converters*
S-12	SLO-1	*Oscillator Operation*	*FPGA Basics*	*Programmable Logic Arrays*	*State table*	*Problem*
	SLO-2	*Crystal Oscillator*	*Introduction to HDL and logic simulation*	*HDL Gate and Data Flow modeling*	*Flow table*	*A/D Conversion*
S-13	SLO-1	*Overview of UJT, Relaxation Oscillator,555 Timer*	*HDL System primitives, user defined primitives, Stimulus to the design*	*HDL Behavioral modeling*	*Analysis of asynchronous sequential circuits*	*Types of A/D conversion*
	SLO-2	*Problem solving session*	*Problem solving session*	*Problem solving session*	*Problem solving session*	*Problem solving session*
S 14-15	**SLO-1** / **SLO-2**	*Lab 3:Design and implement using simulator a rectangular waveform generator (Op-Amp relaxation oscillator)*	*Lab 6: HDLProgram to realize delay and stimulus in simple circuit*	*Lab 9: HDL program for combinational circuits*	*Lab 12: HDL program for Sequential circuits*	*Lab 15: Design and Implement an A/D Converter.*

Learning Resources	*1. Robert L. Boylestad& Louis Nashelsky, Electronic Devices & Circuit Theory, 11th ed., Pearson, 2013* *2. Anil K Maini, Varsha Agarwal: Electronic Devices and Circuits, Wiley, 2012* ***3.** Paul Tuinenga, SPICE: A Guide to Circuit Simulation and Analysis Using PSpice, 3rd ed., Prentice-Hall, 1995,*	*4. Douglas A, G.K. Kharate, Digital Electronics, Oxford university Press,2012* *5. M. Morris R. Mano, Michael D. Ciletti, Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog, 6th ed., Pearson, 2018* *6. A.P. Malvino, Electronic Principles,7th Edition, Tata Megraw Hill Publications, 2013*

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	*10%*	*10%*	*05%*	*05%*	*05%*	*05%*	*05%*	*05%*	*05%*	*05%*
Level 2	Understand	*10%*	*10%*	*05%*	*05%*	*05%*	*05%*	*05%*	*05%*	*05%*	*05%*
Level 3	Apply	30%	20%	*10%*	*10%*	*15%*	*15%*	*05%*	*05%*	*20%*	*20%*
Level 4	Analyze	-	*10%*	*10%*	*10%*	*15%*	*15%*	*10%*	*10%*	*20%*	*20%*
Level 5	Evaluate	-	-	*20%*	*20%*	*10%*	*10%*	*10%*	*10%*	-	-
Level 6	Create	-	-	-	-	-	-	*15%*	*15%*	-	-
	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. Dr.**Devi Jayaraman , Virtusa, devij@virtusa.com*	***1.Dr. J. Dhalia Sweetlin, Anna University,jdsweetlin@mitindia.edu***	***1. Dr. Annapurani Panaiyappan.K, SRMIST***	
***2. Dr. Viswanadhan, Teken BIM Technologies,** viswanathan_alladi@yahoo.com*	***2. Dr. B. Latha, Sairam Engineering College, hod.cse@sairam. edu.in***	***2. Dr. D. Anitha, SRMIST***	***3. Ms. Kayalvizhi Jayavel, SRMIST***

Course Code	18CSS202J	Course Name	COMPUTER COMMUNICATIONS	Course Category	S	Engineering Sciences	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 Objective:	The purpose of learning this course is to:
1	Understand the basic services and concepts related to Internetwork
2	Understand the layered network architecture
3	Acquire knowledge in IP addressing
4	Exploring the services and techniques in physical layer
5	Understand the functions of Data Link layer
6	Implement and analyze the different Routing Protocols

Course Outcomes (CO):	At the end of this course, learners will be able to:	Learning 1-6 Level of Thinking	Expected	Expected	PLO 1 Engineering	PLO 2 Problem Analysis	PLO 3 Design &	PLO 4 Analysis, Design,	PLO 5 Modern Tool Usage	PLO 6 Society & Culture	PLO 7 Environment &	PLO 8 Ethics	PLO 9 Individual & Team	PLO 10 Communication	PLO 11 Project Mgt. &	PLO 12 Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CO-1	Apply the knowledge of communication	4	60	70	3	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO-2	Identify and design the network topologies	4	60	70	3	2	3	-	-	-	-	-	-	-	-	3	-	-	-
CO-3	Design the network using addressing schemes	4	60	70	3	3	3	-	-	-	-	-	-	-	-	3	-	-	-
CO-4	Identify and correct the errors in transmission	4	60	70	3	2	-	-	-	-	-	-	-	-	-	3	-	-	-
CO-5	Demonstrate knowledge on guided and unguided transmission media	4	60	70	3	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO-6	Implement the various Routing Protocols	4	60	70	3	3	3	-	-	-	-	-	-	-	-	3	-	-	3

Duration (hour)		12	12	12	12	12
S-1	SLO-1	Evolution of Computer Networks, Network categories	IPv4 Addressing, Address space	Line coding: Unipolar scheme	Framing, Flow Control Mechanisms	Forward Techniques, Forwarding Process
	SLO-2	Data Transmission Modes, Network topologies	Dotted Decimal Notation. Classful Addressing	Polar schemes, Bipolar schemes	Sender side Stop and Wait Protocol, Receiver side Stop and Wait Protocol	Routing Table
S-2	SLO-1	Circuit Switching and Packet Switching	Subnet Mask	Amplitude shift keying, Frequency shift keying	Goback N ARQ, Selective Reject ARQ	Intradomain Routing and Interdomain Routing
	SLO-2	Protocols and standards	Subnetting	Phase shift keying, Pulse code Modulation, Delta Modulation	CRC, Checksum	Static Routing and Dynamic Routing
S 3-4	SLO-1 SLO-2	Lab 1: IP Addressing	Lab 4:Router Configuration (Creating Passwords, Configuring Interfaces)	Lab 7: RIP v1	Lab 10: EIGRP Authentication and Timers	Lab 13: Examining Network Address Translation (NAT)
S-5	SLO-1	Layers in the OSI model, Functions of Physical layer, data link layer	Special Addresses	Multiplexing: FDM	Types of Errors	Distance Vector Routing, Problem Solving
	SLO-2	Functions of Network layer, Transport layer	Special Addresses	Multiplexing: FDM	Types of Errors	Link state Routing
S-6	SLO-1	Functions of Session, Presentation layer and Application layer	Classless Addressing	TDM	Forward Error correction	Problem solving
	SLO-2	TCP/IP protocol suite ,Link layer protocols	Problem Solving	WDM	CSMA, CSMA/CD	Path vector Routing
S 7-8	SLO-1 SLO-2	Lab 2: Subnetting (VLSM)	Lab 5: Basic Switch Configuration: Vlan	Lab 8: RIP v2	Lab 11: Single-Area OSPF Link Costs and Interface	Lab 14: BGP Configuration

S-9	SLO-1	***Network layer protocols***	***Private Address, NAT, Supernetting***	***Guided Media: Twisted Pair, Coaxial Cable Fiber optic cable***	***Hamming Distance***	***RIP v1,RIP v2***
	SLO-2	***Transport layer protocols***	*Hub, Repeaters, Switch*	***Unguided media: Radio waves***	***Correction Vs Detection***	***OSPF***
S-10	SLO-1	***Serial and Parallel Transmissions***	*Bridge*	***Microwaves***	*HDLC*	***EIGRP***
	SLO-2	***Addressing***	*Structure of Router*	***Infrared***	*PPP*	***BGP***
S 11-12	**SLO-1 SLO-2**	***Lab 3:*** *LAN Configuration using straight through and cross over cables*	***Lab 6:*** *Static and Default Routing*	*Lab 9: EIGRP Configuration, Bandwidth, and Adjacencies*	***Lab 12:*** *Multi-Area OSPF with Stub Areas and Authentication*	*Lab 15: Configuring Static and Default Routes*

Learning Resources	1. *Behrouz A. Forouzan, "Data Communications and Networking" 5th ed., 2010* 2. *Bhushan Trivedi," Data Communication and Networks" 2016*	3. *William Stallings, Data and Computer Communications,9th ed., 2010* 4. *Todd Lammle, CCNA Study Guide, 7th ed. 2011*

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 (5%)	Practice (5%)	Theory (7.5%)	Practice (7.5%)	Theory (7.5%)	Practice (7.5%)	Theory (5%)	Practice (5%)	Theory (25%)	Practice (25%)
Level 1	Remember	10%						10%			10%
Level 2	Understand	20%	10%	10%	15%	25%	10%	15%	10%	15%	10%
Level 3	Apply	10%	20%	30%	20%	15%	20%	15%	20%	20%	20%
Level 4	Analyze	10%	20%	10%	15%	10%	20%	10%	20%	15%	10%
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.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
1. Dr. Viswanadhan, Teken BIM Technologies, *viswanathan_alladi@yahoo.com*	***1.Dr. J. Dhalia Sweetlin, Anna University,jdsweetlin@mitindia.edu***	***1. Mrs. T. Manoranjtham , SRMIST***	
2. Dr.*Devi Jayaraman , Virtusa, devij@virtusa.com*	*2. Dr. B. Latha, Sairam Engineering College, hod.cse@sairam. edu.in*	***2. Mr. J. Godwin Ponsam, SRMIST***	***Dr. J.S. Femilda Josephin, SRMIST***

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY
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Course Code	18CSE351T	Course Name	COMPUTATIONAL LOGIC	Course Category	E	Professional Elective	L	T	P	C

Course Objective	The purpose of learning this course is to:
1	Understand the basics of Propositional logic
2	Acquire skills on rules to handle Propositional logic
3	Understand the First order Logic and Meta theorems
4	Learn the art of application of AI Concepts.
5	Master various Logics

Course Outcomes (CO):	At the end of this course, learners will be able to:	Learning		
		1	2	3
		Level of Thinking	Expected Proficiency	Expected Attainment
CO-1 :	Apply the skills acquired on propositional logic to solve examples at hand	5	80	85
CO-2 :	Apply the rules learnt towards problem solving	5	75	80
CO-3 :	Exhibit mastry over FOL and Meta theorems and apply the same	5	85	80
CO-4 :	Analyze and use appropriate logics for problem solving	5	80	75
CO-5 :	Demonstrate ability to use higher modal logic for solving problems	6	75	85

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

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Propositional Logic-Introduction	Natural Deduction of Propositional Logic: Rules of Conjunction, Disjunction	First Order Logic-Introduction	Axiomatic System FC: Introduction	Modal Logic K-Introduction
	SLO-2	Syntax of PL	Natural Deduction of Propositional Logic: Implication, Negation	First Order Logic-Illustration	Axiomatic System FC: Example applications, Illustrations	Modal Logic K-Illustration
S-2	SLO-1	Is It a Proposition?	Natural Deduction of Propositional Logic: Proofs	Syntax of FL	Monotonicity Theorem-Detail	Syntax and Semantics of K
	SLO-2	Unique Parsing, PropDet	Natural Deduction of Propositional Logic: Examples	Scope and Binding	Deduction Theorem- Detail	Syntax and Semantics of K: Illustration
S-3	SLO-1	Sub Propositions, Precedence rules	Natural Deduction of Propositional Logic: Problems	Scope and Binding-Illustration	Theorem-RA, Fitness- Detail	Validity and Consequence in K
	SLO-2	Proposition: Theorems and Examples	Natural Deduction of Propositional Logic: Problems	Substitutions	Paradox of material Implication-Detail	Validity and Consequence in K: Illustration
S-4	SLO-1	Interpretations	Derived Rules of Propositional Logic: Introduction	Substitutions- Illustrations	Strong Generalization Theorem:Introduction	Axiomatic System KC
	SLO-2	Boolean conditions, Truth table	Derived Rules of Propositional Logic: Examples	Substitutions- Problems	Strong Generalization Theorem: Illustration	Axiomatic System KC: Illustration
S-5	SLO-1	Interpretations: Theorems, Conventions and Lemma	Derived Rules of Propositional Logic:Problems	Semantics of FL	Adequacy of FC to FL	Adequacy of KC to K
	SLO-2	Interpretations: Examples	Derived Rules of Propositional	Semantics of FL: Illustration	Adequacy of FC to FL: Illustration	Adequacy of KC to K: Illustration

			Logic:Problems			
S-6	SLO-1	Models: Introduction to terminologies	Parse Tree	Translating into FL	Compactness of FL	Natural Deduction in K
	SLO-2	Equivalences and Consequences : Introduction to terminologies	Sub Formula	Translating into FL: Illustrations	Compactness of FL: Proof	Natural Deduction in K: Illustration
S-7	SLO-1	Equivalences and Consequences : Examples	Soundness of Propositional Logic	Satisfiability and Validity	Laws in FL	Analytic Tableau for K
	SLO-2	Deduction Theorem (DT)- Introduction	Soundness of Propositional Logic: Illustration	Satisfiability and Validity:Illustrations	Laws in FL: Illustration	Analytic Tableau for K: Illustration
S-8	SLO-1	RA Theorem, Monotonicity Theorem (M)- Introduction	Completeness of Propositional Logic	Metatheorems: Introduction	Natural Deduction	Modalities
	SLO-2	Fitness Theorem	Completeness of Propositional Logic: Illustration	Metatheorems: Deduction, Substitution, Chaining	Natural Deduction: Illustration	Modalities: Illustration
S-9	SLO-1	Theorem-Paradox of material Implication	Gentzen sequent calculus	Metatheorems: Examples	Analytic Tableaux	Computation Tree Logic
	SLO-2	Replacement Laws	Gentzen sequent calculus: Illustration	Metatheorems: Problems	Analytic Tableaux: Illustration	Computation Tree Logic: Illustration

Learning Resources	1. Arindama Singh,"Logics for Computer Science", PHI Learning Private Ltd,2nd Edition,2018 2. Wasilewska & Anita,"Logics for computer science: classical and non-classical",Springer,2018 3. Huth M and Ryan M ,‖ Logic in Computer Science : Modeling and Reasoning about systems‖,Cambridge University Press, 2005	4. Dana Richards & Henry Hamburger,"Logic And Language Models For Computer Science",Third Edition,World Scientific Publishing Co. Pte. Ltd,2018. 5. https://www.cs.cornell.edu/courses/cs3110/2012sp/lectures/lec15-logic-contd/lec15.html

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	10 %	-	10 %	-	10 %	-	10 %	-	10 %	-
Level 2	Understand	20 %		20 %		20 %		20 %		20 %	
Level 3	Apply	40 %		40 %		40 %		20 %		40 %	
Level 4	Analyze	20 %		20 %		20 %		30 %		20 %	
Level 5	Evaluate	10 %		10 %		10 %		10 %		10 %	
Level 6	Create	-		-		-		10%		-	
	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. Paventhan Arumugum, Director (R&D), ERNET India		Mr. T.Senthil Kumar, SRMIST
Mr Shiv Kumar Ganesh Full stack developer Altemetric, US		Dr.Kayalvizhi Jayavel, SRMIST
		Ms. Jeyasudha, SRMIST

Course Code	18CSE352T	Course Name	NEURO FUZZY AND GENETIC PROGRAMMING	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 Objective:	*The purpose of learning this course is to:*	**Learning**
1	*Understand the fundamentals of Artificial Neural Networks*	1-6
2	*Learn the various topologies and learning algorithms of ANN*	
3	*Understand the principles and fundamentals of Fuzzy Logic*	
4	*Understand the principles and fundamentals of Fuzzy Logic*	
5	*Understand the basic concepts and techniques of Genetic Algorithms and Utilize the Genetic Algorithms for real-time application development*	

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Level of Thinking	Expected	Expected
CO-1 :	*Acquire the knowledge on constructing a neural network*	*5*	*80*	*75*
CO-2 :	*Identify the basic Neural net and learning algorithm to apply for a real time problem*	*5*	*85*	*75*
CO-3 :	*Acquire the ability to use Fuzzy operators, membership functions, Fuzzification and Defuzzification Techniques*	*5*	*75*	*70*
CO-4 :	*Gain Knowledge on applying the Fuzzy rules to different applications*	*5*	*85*	*80*
CO-5 :	*Acquire the knowledge of fitness functions, Genetic operators and applications of Genetic Algorithm to real time problems.*	*5*	*85*	*75*

Program Learning Outcomes (PLO)													Program Specific Outcome (PSO)		
1	2	3	4	5	6	7	8	9	10	11	12			
Engineering	Problem Analysis	Design &	Analysis, Design,	Modern Tool Usage	Society & Culture	Environment &	Ethics	Individual & Team	Communication	Project Mgt. &	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
3	*2*	*2*	-	-	-	-	-	-	-	-	*3*	-	-	-
3	*2*	*2*	-	-	-	-	-	-	-	-	*3*	-	-	-
3	*2*	*2*	-	-	-	-	-	-	-	-	*3*	-	-	-
3	*2*	*2*	-	-	-	-	-	-	-	-	*3*	-	-	-
3	*2*	*2*	-	-	-	-	-	-	-	-	*3*	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Biological and Artificial Neuron*	*Delta Rule, Derivation of GDR*	*Crisp sets*	*Fuzzification of Input Variables, Application of Fuzzy operations*	*History of Evolutionary Computing, Genetic Algorithms, basic concepts*
	SLO-2	*History of ANN*	*Backpropagation Algorithm, Local Minima Problem*	*Fuzzy sets*		*GA Cycle , Fitness Function,*
S-2	SLO-1	*ANN architectures*	*Radial Basis Function Neural Network*	*Fuzzy membership functions*	*Evaluation of Fuzzy rules, Aggregation of output Fuzzy sets*	*Introduction to GA Operators Selection Operators, Crossover, Mutation Operations*
	SLO-2	*Learning Algorithms*	*Pattern Association, Auto Associative nets*	*Operations of Fuzzy sets*		
S-3	SLO-1	*Activation Functions, Bias, Threshold and other parameters*	*Hetero Associative nets*	*Fuzzy Relations, Operations*	*Rule based systems, Conventional programs vs Rule based systems*	*Schema Theorem, Example*
	SLO-2	*McCulloch Pitts model,*	*Bidirectional Associative Memory Network*	*Fuzzy Extension Principle*	*Fuzzy Propositions*	
S-4	SLO-1	*Simulation of Logic Functions*	*Hopfield network Competitive networks: Maxnet*	*Crisp Relations, Fuzzy relations, Properties, operations*	*Fuzzification*	*Classification of Genetic Algorithm*
	SLO-2					
S-5	SLO-1	*Perceptron Network*	*Self Organizing Map Network*	*Propositional Logic*	*Defuzzification*	*Holland Classifier Systems*
	SLO-2	*Hebbian network*	*Learning Vector Quantization*	*Crisp Logic*	*Fuzzy Controller : Air conditioner control, Cruise Controller*	*Genetic Programming*
S-6	SLO-1	*ADALINE networks*	*Adaptive Resonance Theory Network*	*Predicate Logic Rules of Inference*	*Fuzzy Decision making*	*Data Representation*

	SLO-2	*MADALINE networks*		*Fuzzy Truth, Fuzzy Rules*		*Genetic Operators*
S-7,8	SLO-1	*Practice of Neural Network tool : Simple Logic functions*	*Practice of Neural Network tool : Delta rule*	*Fuzzy Reasoning*	*Introduction to neuro fuzzy systemAdaptive Neuro-Fuzzy Inference Systems Coactive Neuro-Fuzzy Modeling*	*Application of Genetic Algorithm*
	SLO-2		*Practice of Neural Network tool : Pattern Classification*			
S-9	SLO-1	*Practice of Neural Network tool : XOR problem*	*Practice of Neural Network tool : Pattern Clustering*	*Practice of Fuzzy Logic tool: Fuzzy functions*	*Recent Applications*	*Practice of Optimization and Genetic algorithm tool*
	SLO-2			*Practice of Fuzzy Logic tool: Fuzzy operations*	*Practice of Fuzzy Logic tool : Fuzzy controller design and applications*	

Learning Resources	1. *Samir Roy, Udit Chakraborty, —Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithm, Pearson Education, 2013.* 2. *Michael Negnevitsky. Artificial Intelligence: A Guide to Intelligent Systems, 3rd Edition, Pearson Education, 2011.* 3. *Laurene Fausett, "Fundamentals of Neural Networks, Architectures, Algorithms and Application, Pearson Education, 2008*	4. *Timothy J. Ross , —Fuzzy Logic with Engineering Application, John Wiley & Sons Ltd,2010.* 5. *David E. Goldberg, —Genetic Algorithms-In Search, optimization and Machine Learnin, Pearson Education, 2008.*

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 (7.5%)	Practice	Theory (7.5%)	Practice	Theory (5%)	Practice	Theory (25%)	Practice
Level 1	Remember	20%	-	15%	-	15%	-	15%	-	15%	-
Level 2	Understand	20%	-	15%	-	15%	-	15%	-	15%	-
Level 3	Apply	20%	-	30%	-	30%	-	30%	-	30%	-
Level 4	Analyze	20%	-	30%	-	30%	-	30%	-	30%	-
Level 5	Evaluate	20%	-	10%	-	10%	-	10%	-	10%	-
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.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. K. selvaraj, TCS, Bangalore	*1, Dr. A.P. Shanthi, Professor, Dept. of Computer Science & Engineering, Anna University, chennai-600025*	*1. Dr. V. Ganapathy, SRM IST*
2. Mr. Saju G Nair, IBM, Bangalore	*2. Dr. A, Kannan, Professor, Dept. of Computer Science & Engineering, VIT, Vellor*	*2. Dr. D. Malathi, SRM IST*
		3. Dr. Ferni Ukrit, SRM IST

Course Code	18CSE353T	Course Name	DIGITAL IMAGE PROCESSING	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	Computing Technologies	Data Book / Codes/Standards	Nil		

Course Objective:	The purpose of learning this course is to:
1	Study the basic concepts of digital image.
2	Provide understanding of spatial and frequency domain analysis of image.
3	Provide knowledge of image restoration and segmentation techniques.
4	Provide understanding of image compression techniques
5	Provide knowledge of image segmentation and recognition techniques.
6	Study the modern tools usage in image processing

Course Outcomes (CO):	At the end of this course, learners will be able to:	Learning		
		1	2	3
		Level of Thinking	Expected	Expected
CO-1 :	Explore the basics of digital images.	4	70	80
CO-2 :	Analyse the images in the frequency domain and spatial domain.	4	60	70
CO-3 :	Explore the image restoration and image enhancement techniques	4	60	70
CO-4 :	Extrapolate various compression techniques.	4	60	70
CO-5 :	Explore image segmentation, representation and recognition techniques.	4	60	70
CO-6 :	Apply image processing techniques using modern tools.	5	70	85

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

Duration (hour)		12	12	12	12	12
S-1	SLO-1	Introduction	Introduction to Spatial Domain	Noise models – Mean Filters – Order Statistics	Wavelets – Subband coding – Multiresolution expansions	Boundary representation – Chain Code
S-2	SLO-1	Origin- Steps in Digital Image Processing	Gray level transformations	Adaptive filters – Band reject Filters – Band pass Filters	Fundamentals of Compression – Image Compression methods - Error Free Compression	Polygonal approximation, signature, boundary segments
S-3	SLO-1	Components	Histogram processing	Inverse Filtering – Wiener filtering Segmentation	Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding	Boundary description – Shape number
S-4	SLO-1	Elements of Visual Perception	Basics of Spatial Filtering	Point, Line, and Edge Detection	Lossy Compression – Lossy Predictive Coding	Fourier Descriptor
S-5	SLO-1	Image Sensing and Acquisition	Smoothing and Sharpening Spatial Filtering	Marr-Hildreth & Canny edge detector	Compression Standards- Huffman, Arithmetic coding, LZW coding, Run Length Encoding	Regional Descriptors
S-6	SLO-1	Image Sampling and Quantization	Frequency Domain: Basics of filtering	Edge Linking and Boundary detection	Compression Standards Huffman, Arithmetic coding, LZW coding, Run Length Encoding	Topological - Texture – Patterns and Pattern classes
S-7	SLO-1	Relationships between pixels	Smoothing and Sharpening frequency domain filters	Local & Regional processing- Region based segmentation	Block Transform coding, Wavelet coding, JPEG standard	Recognition based on matching

S-8	SLO-1	*Introduction to Image processing toolbox in MATLAB*	*Smoothing and Sharpening frequency domain filters*	*Morphological processing- Watershed segmentation algorithm*	*MATLAB code for image compression: Huffam coding, Arithmetic coding, wavelet coding*	*MATLAB code for image representation*
S-9	SLO-1	*Tool box practice*	*MATLAB code for histogram equalization*	*MATLAB code for restoring an image after degradation using adaptive and wiener filter*	*MATLAB code for image compression: Huffam coding,*	*MATLAB code for image recognition*
	SLO-2	*Exploring functions*	*MATLAB code for spatial and frequency domain filter.*	*Edge detection operators*	*Arithmetic coding, wavelet coding*	*MATLAB Practice exercises*

Learning Resources	*1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing Pearson, Third Edition, 2011.*	*2. Anil K. Jain, Fundamentals of Digital Image Processing Pearson, 2002.*

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%	-	15%	-	15%	-	-	-	15%	-
Level 2	Understand	20%	-	25%	-	25%	-	-	-	25%	-
Level 3	Apply	45%	-	40%	-	40%	-	40%	-	30%	-
Level 4	Analyze	15%	-	20%	-	20%	-	30%	-	30%	-
Level 5	Evaluate	-	-	-	-	-	-	30%	-	-	-
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.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Madhan Thandayithapani kutiyappan, Assistant consultantant, TCS - siruseri	Dr. S. Sridhar, Anna University	Dr. G.Niranjana. Associate Professor/CSE
	Dr. Senthil kumar, Annauniversity	Mr. Rajasekar Assistant Professor/IT
		Mr. James Joseph Assistant Professor/SWE

Course Code	18CSE354T	Course Name	NETWORK SECURITY	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	CSE	Data Book / Codes/Standards	Nil		

Course Objectives	The purpose of learning this course is to:	Learning		
		1	2	3
1	Gain knowledge about the different types of attacks that occur over computer networks	Bloom`s Level (1-6)	Expected Proficiency (%)	Expected Attainment (%)
2	Describe the security mechanism used in the different layers of network			
3	Understand the various protocols used to provide the security services for mail communication.			
4	Explore about the various methods and protocols to maintain security at transport layer			
5	Ascertain knowledge of the security measures for wireless and cell phone Communications			

Course Outcomes (CO):	At the end of this course, learners will be able to:	Learning			Program Outcomes (PO)												PSO		
					1	2	3	4	5	6	7	8	9	10	11	12			
		Bloom`s Level (1-6)	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
CO-1 :	Identify and determine the prevention mechanism for different types of attacks over the network	3	60	70	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2 :	Exhibit knowledge about the security protocols used in the network layer	4	60	70	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-3 :	Analyze the security services supported in e-mail communication	3	60	70	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-4 :	Demonstrate ability to decide on the transport layer protocols for maintaining security	3	60	70	3	-	-	-	-	-	-	-	-	-	-	-	-	-	1
CO-5 :	Express ability to analyze the security aspects applicable for wireless communication	4	60	70	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Networking Devices(Layer1,2)	Overview of IPSEC- Security Associations, Security Association Database	Security Services for E-mail	SSL/TLS Basic Protocol	Wireless Security:IEEE 802.11 Wireless LAN
	SLO-2	Networking Devices(Layer 3)	Security Policy databases , AH and ESP	Security Services for E-mail	SSL/TLS Basic Protocol	Wireless Security:IEEE 802.11 Wireless LAN
S-2	SLO-1	Different types of network layer attacks	Tunnel and Transport mode	Establishing keys	computing the keys	Authentication
	SLO-2	Different types of network layer attacks	IP header Protection	Establishing Public and secret keys	computing the keys	Authentication and confidentiality
S-3	SLO-1	Firewall- ACL	IP and IPv6	Privacy	client authentication	Cellphone Security
	SLO-2	Packet Filtering	IPV4 and IPV6 header	End-to end Privacy, Privacy with distribution List Exploders	client authentication	GSM (2G) Security
S-4	SLO-1	DMZ, Alerts	Authentication Header	Authentication of the source	PKI as deployed by SSL	Security in UMTS (3G)
	SLO-2	Audit Trials	Mutable, Immutable and Mutable but predictable	Based on public key technology and secret keys and with distribution list	PKI as deployed by SSL	Security in UMTS (3G)
S-5	SLO-1	IDS	Encapsulation Security Payload(ESP)	Message Integrity	SSLAttacks fixed in v3	Wireless LAN Vulnerabilities
	SLO-2	Advantages and Disadvantages of IDS(Need of IPS)	Internet Key Exchange	Non-repudiation	SSLAttacks fixed in v3	Phishing
S-6	SLO-1	Advantages of IPS ove IDS	Phases of IKE	Introduction and Overviw of PGP	Exportability	Buffer Overflow
	SLO-2	IPS	Phase I IKE- Modes and key types	Efficient Encoding	Exportability	Buffer Overflow
S-7	SLO-1	IPS Types- Signature based	Phase I IKE Protocols	Certificate and key revocation	Encoding	Format String Attacks
	SLO-2	Anomaly based, Policy based	Phase I IKE Protocols	Singature types, Private key, Fing types	Encrypted Record	Cross-site Scripting (XSS)
S-8	SLO-1	IPS Types - Honeypot based	Phase II IKE	Anomalies	Handshake messages	SQL Injection
	SLO-2	Applications	Phase II IKE	Object Format	Changecipherspec and Alerts	SQL Injection
S-9	SLO-1	Malicious Software	ISAKMP/IKE Encoding	S/MIME	SET	Case Studies: Secure Inter-branch Payment Transactions
	SLO-2	Malicious Software	ISAKMP/IKE Encoding	S/MIME	SET	Virtual Elections

Learning Resources		
	1. *Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security, Prentice Hall of India, 2002.* 2. *Bernard Menezes - Network Security and Cryptography- Cengage Learning. 2010.*	3. *William Stallings, Cryptography and Network Security - Principles and Practice, 7th edition, Pearson Publication, 2017* 4. *Cryptography and network security , AtulkahateTata McGraw-Hill Education,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	25%	-	20%	-	20%	-	20%	-	20%	-
Level 2	Understand	25%	-	20%	-	20%	-	20%	-	20%	-
Level 3	Apply	50%	-	35%	-	25%	-	25%	-	25%	-
Level 4	Analyze	-	-	25%	-	35%	-	35%	-	35%	-
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.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. M. Sudhakar, M.Tech, (Ph.D)-IIT, IT Infrastructure Service, Tata Consultancy Services.	*Dr. P. Yogesh, Associate Professor, Dept of Information Science and Technology, College of Engineering, Guindy,*	*Dr. A. Jeyasekar, Associate Professor* *Dr. J. Femilda, Associate Professor* *Mrs. G. Sujatha, Assistant Professor*

Course Code	18CSE355T	Course Name	DATA MINING AND ANALYTICS	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	CSE	Data Book / Codes/Standards		Nil	

Course Objective	*The purpose of learning this course is to:*
1	*Steps involved in data mining*
2	*Analyze and use classification algorithms*
3	*Understand the algorithms used for Supervised learning*
4	*Understand and use distance measuring methods*
5	*Apply outlier detection using statical models both parametric and non-parametric methods*

Course Learning Outcomes (CO):	*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	PSO		
		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
CO-1 :	Express the knowledge on the concepts of Data Mining	4	60	75	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2 :	Analyse and Apply Association rule mining techniques	4	65	70	3	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO-3 :	Apply various Classification algorithms	4	65	70	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO-4 :	Demonstrate ability to decide and use distance measures for decision making	4	60	75	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO-5 :	*Exhibit knowledge to use statistical models for outlier detection*	4	65	70	3	3	3	1	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Why Data mining? What is Data mining ?*	*Mining frequent patterns: Basic concepts*	*Classification: Basic concepts*	*Cluster Analysis: Introduction*	*Outliers: Introduction*
	SLO-2	*Kinds of data meant for mining*	*Market Basket Analysis*	*General approach to Classification*	*Requirements and overview of different categories*	*Challenges of outlier detection*
S-2	SLO-1	*Kinds of patterns that can be mined*	*Frequent itemsets, Closed itemsets*	*Decision tree induction*	*Partitioning method: Introduction*	*Outlier detection methods: Introduction*
	SLO-2	*Applications suitable for data mining*	*Association rules-Introduction*	*Algorithm for Decision tree induction*	*k-means*	*Supervized and Semi-supervized methods*
S-3	SLO-1	*Issues in Data mining*	*Apriori algorithm-theoritical approach*	*Numerical example for Decision tree induction*	*k-medoids*	*Unsupervized methods*
	SLO-2	*Data objects and Attribute types*	*Apply Apriori algorithm on dataset-1*	*Attribute selection measure*	*Hierarchical method: Introduction*	
S-4	SLO-1	*Statistical descriptions of data*	*Apply Apriori algorithm on dataset-2*	*Tree pruning*	*Agglomerative vs. Divisive method*	*Statistical and Proximity based methods*
	SLO-2		*Generating Association rules from frequent itemsets*	*Scalability and Decision tree induction*	*Distance measures in algorithmic methods*	
S-5	SLO-1	*Need for data preprocessing and data quality*	*Improving efficiency of Apriori*	*Bayes' Theorem*	*BIRCH technique*	*Statistical approaches*
	SLO-2			*Naïve Bayesian Classification*		
S-6	SLO-1	*Data cleaning*	*Pattern growth approach*	*IF-THEN rules for classification*	*DBSCAN technique*	*Statistical data mining*
	SLO-2	*Data integration*		*Rule extraction from a decision tree*		
S-7	SLO-1	*Data reduction*	*Mining frequest itemsets using Vertical data format*	*Metrics for evaluating classifier performance*	*STING technique*	*Data mining and recommender systems*
	SLO-2		*Strong rules vs. weak rules*	*Cross validation*		
S-8	SLO-1	*Data transformation*	*Association analysis to Correlation analysis*	*Bootstrap*	*CLIQUE technique*	*Data mining for financial data analysis*
	SLO-2			*Ensemble methods-Introduction*		
S-9	SLO-1	*Data cube and its usage*	*Comparison of pattern evaluation measures*	*Bagging and Boosting*	*Evaluation of clustering techniques*	*Data mining for Intrusion detection*
	SLO-2			*Random Forests: Introduction*		

Learning Resources	1. *Jiawei Han and Micheline Kamber, " Data Mining: Concepts and Techniques", 3rd Edition, MorganKauffman Publishers, 2011.* 2. *Pang-Ning Tan , Michael Steinbach "Introduction to Data Mining-Introducing the fundamental concepts and algorithms of data mining (2nd Edition)" Pearson publisher,2020*	3. *Gordon S. Linoff , Michael J. A. Berry " Data Mining Techniques: For Marketing, Sales, and Customer Relationship Management " Wiley; 3rd edition (April 12, 2011)* 4. *Trevor Hastie , Robert Tibshirani , Jerome Friedman "The Elements of Statistical Learning: Data Mining, Inference, and Prediction", Second Edition (Springer Series in Statistics) 2nd Edition, Springer; 2nd edition (January 1, 2016)*

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 %	-	40 %	-	30 %	-	20 %	-	30 %	-
Level 4	Analyze	30%	-	20%	-	30%	-	40%	-	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.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		1. Dr.L.N.B.Srinivas, SRMIST
		2. Dr.S.Karthick, SRMIST
		3.Dr.Akilandeswari.P, SRMIST

Course Code	18CSE356T	Course Name	DISTRIBUTED OPERATING SYSTEMS	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 Objectives :	The purpose of learning this course is to:	Learning
1	*To recognize the essential concepts of distributed system.*	1 - 6
2	*To comprehend about the communication that takes place in Distributed systems*	
3	*To realize the necessity of synchronization, consistency and Fault tolerance in a Distributed System.*	
4	*To value the Process management, File systems, Shared memory*	
5	*To acquire apparent scheme regarding distributed object-oriented based systems*	

Course Outcomes (CO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficency (%)	Expected Attainment (%)
CO-1 :	*Characterize the fundamental hardware and software concepts of distributed systems.*	*3*	*60*	*70*
CO-2 :	*Categorize layered protocols and comprehend the communications in distributed systems*	*4*	*60*	*70*
CO-3 :	*Implement synchronization of distributed systems using various algorithms.*	*4*	*60*	*70*
CO-4 :	*Demonstrate process scheduling and fault tolerance of distributed systems.*	*4*	*60*	*70*
CO-5 :	*Evaluate various Distributed Object-Oriented based systems.*	*4*	*60*	*70*

Program Outcomes (PO)												Program Specific Outcome (PSO)		
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	PSO - 1	PSO - 2	PSO – 3
3	-	-	*3*	-	-	-	-	-	-	-	-	-	-	-
3	*3*	-	*2*	-	-	-	-	-	-	-	-	-	-	-
3	*2*	*2*	*3*	-	-	-	-	-	-	-	-	-	*2*	-
3	*3*	-	*3*	-	-	-	-	-	-	-	-	-	*2*	-
3	*3*	-	*2*	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Introduction- Distributed Systems*	*Fundamentals of Communication systems*	*Synchronization in Distributed Systems- Fundamentals of Clock Synchronization*	*Processes and Processors in Distributed Operating Systems - Threads*	*Distributed Shared memory - Introduction*
	SLO-2	*Goals of Distributed Systems*		*Logical clock, Physical clock*	*Design issues of Threads package*	*Bus-Based Multiprocessors*
	SLO-2				*Work Station Model*	*Switched Multiprocessors*
S-2	SLO-1	*Hardware Concepts- Bus-based Multiprocessors*	*Layered Protocols*	*Algorithms for Clock synchronization*	*System Model - Introduction*	*Ring-based Multiprocessors*
S-3	SLO-1	*Switched Multiprocessors*	*ATM networks*	*Mutual Exclusion-Centralized Algorithm*	*Using Idle Work Stations*	*Numa Multiprocessors*
	SLO-2					*Comparison of Shared Memory Systems*
S-4	SLO-1	*Bus-based Multicomputers*	*Client Server model - Blocking Primitives*	*Distributed Algorithm*	*Processor Pool Model, Hybrid Model*	*Consistency Models – Strict Consistency, Casual Consistency, PRAM Consistency*
	SLO-2		*Non-Blocking Primitives*	*Token Ring Algorithm*	*Processor Allocation – Allocation Model*	*Weak Consistency, Release Consistency, Entry Consistency*
S-5	SLO-1	*Switched Multicomputers*	*Buffered Primitives*	*Comparison of all three algorithms*	*Design issues for processor Allocation Algorithms*	*Page Based Distributed Shared Memory – Replication, granularity*
	SLO-2		*Unbuffered Primitives*	*Importance of Election Algorithm*	*Example of processor Allocation Algorithms*	*Finding the Owner,Finding the Copies*
S-6	SLO-1	*Software Concepts-Network Operating System*	*Reliable primitives*	*Bully Algorithm*	*Scheduling in Distributed Systems*	*Page Replacement*
	SLO-2		*Unreliable primitives*	*Ring Algorithm*	*Load Balancing and Sharing Approach*	*Synchronization*
S-7	SLO-1	*True Distributed Systems*	*Message passing and its related issues*	*Atomic Transaction- Introduction*	*Fault Tolerance-Component Faults*	*Shared – Variable Distributed Shared memory*

	SLO-2			*Transaction Model, Concurrency Control*	*System Failures*	*Object Based Distributed Shared memory – DOO Architecture*
S-8	SLO-1	*Multiprocessors Timesharing Systems*	*Remote Procedure Call and its related issues*	*Deadlock in Distributed Systems*	*Synchronous versus Asynchronous Systems*	*Distributed Object-Oriented Process*
	SLO-2			*Distributed Deadlock Detection*	*Fault tolerance Using Active Replication, Primary-backup*	*Distributed Object-oriented Communication*
S-9	SLO-1	*Design Issues-Distributed Systems*	*Case Studies: SUN RPC, DEC RPC*	*Distributed Deadlock Prevention*	*Real Time Distributed Systems-Communication*	*Case Study - Amoeba*
	SLO-2				*Real Time Scheduling*	*Mach-OS, Chorus*

Learning Resources	*1. Andrew S. Tanenbaum, "Distributed Operating Systems "PearsonEducation, 2011.* *2. Pradeep K. Sinha "DistributedOperatingSystems Concepts and Design "PHI 2012.*	*3. Mukesh Singhal, Niranjan G Shivratri "Advanced concepts in Operating Systems ", Mc Graw Hill International 2011.* *4. http://www.seas.gwu.edu/~jstanton/courses/cs251/* *5.http://cse.yeditepe.edu.tr/~sbaydere/courses new/cse532/*

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 (7.5%)	Practice	Theory (5%)	Practice	Theory (50%)	Practice
Level 1	Remember	20%	-	20%	-	20%	-		-	15%	-
Level 2	Understand	20%	-	20%	-	20%	-	15%	-	30%	-
Level 3	Apply	60%	-	15%	-	15%	-	45%	-	35%	-
Level 4	Analyze	-	-	45%	-	45%	-	25%	-	20%	-
Level 5	Evaluate	-	-	-	-	-	-	15%	-	-	-
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.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
JP Vinjamoori, Director, Pavartha Software Pvt.Ltd, jp@pavarthasoftware.com	*Dr. E.Sivasankar,NIT,Trichy*	*Mrs. S. Aruna, Dr.G. Maragatham, Mrs. A. Jackulin Mahriba, SRMIST*

Course Code	18CSE357T	Course Name	BIOMETRICS	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 Objectives:	The purpose of learning this course is to:
1 :	Gain knowledge of authentication using biometrics.
2 :	Identify the basics of biometric traits, sensors and data acquisition
3 :	Design of biometric security system
4 :	Gain knowledge on pattern recognition systems
5 :	Analyze various feature extraction and matching techniques for different biological traits.
6 :	Explore the real time application of biometrics

Course Outcomes (CO):	At the end of this course, learners will be able to:	Learning 1 - 6: Level of Thinking	Expected Proficiency	Expected Attainment	Program Outcomes (PO) 1: Engineering Knowledge	2: Problem Analysis	3: Design & Development	4: Analysis, Design,	5: Modern Tool Usage	6: Society & Culture	7: Environment &	8: Ethics	9: Individual & Team Work	10: Communication	11: Project Mgt. & Finance	12: Life Long Learning	PSO: PSO - 1	PSO - 2	PSO – 3
CO-1 :	Exhibit knowledge on basics of biometric traits	4	60	70	3	-	-		-	-	-	-	-	-	-	-	-	-	-
CO-2 :	Analyze the various pattern recognition system and its features	4	60	70	-	3		2	-	-	-	-	-	-	-	-	-	-	-
CO-3 :	Demonstrate ability to differentiate between physical and behavioral biometric traits	4	60	70	3	-	-	2	-	-	-	-	-	-	-	-	-	-	-
CO-4 :	Apply the knowledge of biometrics on developing identification system	4	60	70	-	-	3		-	-	-	-	2	-	-	-	-	-	-
CO-5 :	Design a biometric system	4	60	70	-	-	3		-	-	-	-	2	-	-	-	-	-	2
CO-6;	Incorporate the knowledge on developing authentication systems for real world security applications	4	60	70	-	-	3	-	-	-	2	-	1	-	-	-	-	2	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	Introduction of biometric systems	Biometrics Sensors and Data Acquisition	Introduction to multibiometrics	Biometric system authentication	Biometric Authenticatio n Applications
	SLO-2	Biometric functionalities: verification, identification	Biometric data acquisition and database	Sources of multiple evidence	physiological and behavioral properties of biometric system,	access control like a lock or an airport check-in area
S-2	SLO-1	The design cycle of biometric systems	Biometrics Pre- processing	Acquisition sequence	Software biometrics systems	immigration and naturalization
	SLO-2	Building blocks of a generic biometric system	The related biometrics preprocessing technologies	Processing sequence	Hardware biometrics systems	welfare distribution
S 3-4	SLO-1	Introduction to unimodal system	Image restoration	Fusion level	Security of biometric systems	military application
	SLO-2	Introduction to Multimodal biometric system	Image segmentatio n	Sensor level fusion	Advisory,insider,infrastructure attacks	banking, e.g., check cashing, credit card, ATM
S-5	SLO-1	Biometric system errors	Pattern extraction and classificatio n	Feature level fusion	Attacks at the user interface	computer login; intruder detection; smart card
	SLO-2	Performance measures	Pattern classificatio n	Score level fusion	impersonation, obfuscation, spoofing	multi-media Communicatio n; WWW and an electronic purse
S-6	SLO-1	Image processing basics	Fingerprint Recognition and acquisition	Rank level fusion	Attacks on biometric processing	sensor fusion; decision fusion
	SLO-2	what is image, acquisition, type, point operations, Geometric transformatio ns	Fingerprint features, matching and synthesis	Decision level fusion		categorization : e.g., age and gender

					Attacks on system module and interconnections	
S 7-8	SLO-1	*First and second derivative* **steps in edge detection, smoothening, enhancement,** *thresholding, localization,*	*Face recognition and acquisition* Face detection, feature extraction *And matching*	*Features Matching and Decision Making* Feature matching: null and alternative Hypothesis h0, h1, Error type I/II, Matching score distribution, FM/FNM, ROC curve, DET curve, FAR/FRR *curve.*	*Counter measure: Biometric template security*	*industrial automation*
	SLO-2				*Countermeasure:spoofdecte ction*	*gesture interpretation;*
S-9	SLO-1	*Robert's method, Sobel's method, Perwitts*	Iris recognition and acquisition Iris Segmentatio n, normalizati on and matching	Introduction to Various matching methods:	*Challenges in biometric systems like fool proofing, falsepositives*	*efficient enrollment*
	SLO-2	*Laplacian of Gaussian, Zero crossing*			*Developing Tools for Comparing fingerprints*	*audio-visual tracking*
S-10	SLO-1	*Low level feature extraction, Describing image motion*	*Ear recognition*	LDA PCA, Eigen vectors and values, 2D- PCA, generalizatio n to p-dim, covariance and correlation, algebra of PCA, projection of data	*Enhancing pattern when data is minimum*	*stock market;*
	SLO-2	*High level feature extraction ,Template matching*	*Ear detection*		*Biometric failures in special cases like(too much moisture in hands which system can't read)*	*on-line shopping*
S 11-12	SLO-1	*Hough transform for lines Hough transform for circles and ellipses*	*Hand geometry features*	*Introduction to decision theory and their examples*	*Mini project: Fingerprint, Face detection*	*compact embedded systems other commercialize d services*
	SLO-2		*palmprint features*	Explanation *– examples*	*Mini project:signature ,iris detection*	

Learning Resources	1. *James wayman,Anilk.Jain ,ArunA.Ross ,KarthikNandakumar, —Introduction to. Biometricsll, Springer, 2011* 2. *Mark S.Nixon, Alberto S.Aguado, Feature Extraction and image processing for computer vision, Third Edition, , Elsevier 2012* *3. Digital Image Processing using MATLAB, By: Rafael C. Gonzalez, Richard Eugene Woods, 2nd Edition, Tata McGraw-Hill Education 2010*	4. *Guide to Biometrics, By: Ruud M. Bolle, SharathPankanti, Nalini K. Ratha, Andrew W. Senior, Jonathan H. Connell, Springer 2009* 5. *Pattern Classification, By: Richard O. Duda, David G.Stork, Peter E. Hart, Wiley 2007* *Shimon K.Modi , —Biometrics in Identity Management :concepts to applicationsll, Artech House 2011*

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 (10%)	Practice	Theory (15%)	Practice	Theory (15 %)	Practice	Theory (10%)	Practice	Theory (50%)	Practice
Level 1	Remember	20%		15%		15%		15%		15%	
Level 2	Understand	20%		25%		25%		25%		25%	
Level 3	Apply	45%		40%		40%		40%		40%	
Level 4	Analyze	15%		20%		20%		20%		20%	
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.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Raghu Raghavendra s, Chief Executive Officer at Forensic & Biometric Investigation Services FBIS Chennai, Tamil Nadu, India Chennai Area, India	1. *Dr. J.DhaliaSweetlin Designation:Assistant Professor [Sr Grade]Madras Institute of Technology,MIT Road, RadhaNagar,Chromepet, Chennai,Tamil Nadu 600044 .India.Email:jdsweetlin@mitindia.edu Area of Specialization: Image Processing, Soft Computing*	1. *Dr. C. Malathy, SRMIST* 2. *M.Gayathri, SRMIST* 3. *Ms.Meenakshi/IT Dept,SRMIST*

Course Code	18CSE358T	Course Name	PATTERN RECOGNTION TECHNIQUES	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	CSE	Data Book / Codes/Standards		Nil	

Course Objectives:	The purpose of learning this course is to:	Learning
1	Acquire the principles and fundamentals of Pattern Recognition techniques	1-6
2	Analyze the various Statistical models of Pattern Recognition	
3	Incorporate Clustering concepts for Pattern Recognition problems	
4	Implement Syntactic Pattern Recognition principles and techniques	
5	Develop solutions for problems using Neural Network based Pattern Recognition approaches	

Course Outcomes (CO):	At the end of this course, learners will be able to:	Level of Thinking	Expected Proficiency (%)	Expected Attainment (%)
CO-1 :	Define the different methodologies of Pattern Recognition and identify them of problem solving	4	60	75
CO-2 :	Evaluate and compare the different Statistical based Pattern Recognition techniques	4	60	75
CO-3 :	Demonstrate the ability to apply Clustering concepts for Pattern Recognition problems	4	60	75
CO-4 :	Apply the knowledge of Grammatical and Graph based Syntactic Pattern Recognition principles in problem solving	4	60	75
CO-5 :	Apply the techniques of Neural Pattern Recognition approaches	4	60	75

Program Outcomes (PO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem	Design & Development	Analysis, Design,	Modern Tool	Society &	Environment & Sustainability	Ethics	Individual &	Communication	Project Mgt. &	Life Long	PSO - 1	PSO - 2	PSO – 3
3	3	-	-	-	-	-	-	-	-	-	-	1	-	-
3	3	-	-	-	-	-	-	-	-	-	-	-	-	1
-	3	3	-	-	-	-	-	-	-	-	-	-	1	-
-	3	3	-	-	-	-	-	-	-	-	-	-	1	-
-	3	3	-	2		-	-	-	-	-	-	-	1	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Pattern and features	Introduction to StatPR, Statistical models,	Formulation of unsupervised problems	Syntactic Pattern Recognition, Grammar based approaches,	Neural Networks fundamentals, Learning in Neural networks,
	SLO-2	Classification, Description, Pattern Mappings	Gaussian case and Class Dependence	Illustration	Formal Grammars, Types of Grammars	Physical Neural Networks
S-2	SLO-1	Patterns and Feature Extraction	Discriminant Functions- Uniform Densities	Unsupervised Learning Approaches	String generation as Pattern Description	Artificial Neural Networks model,
	SLO-2	Examples	Classifier Performance, Risk and Errors	Illustration	Example	activation functions, weights
S-3	SLO-1	Classifiers	Supervised learning – Parametric estimation	Clustering for unsupervised learning and classification	Recognition by String Matching and Parsing,	Neural Network based Pattern Associators, CAM
	SLO-2	Example	Maximum Likelihood Estimation	Example	Example	Linear Associative Mappings, Different approaches
S-4	SLO-1	Decision Regions	Bayesian parameter estimation	c-means algorithm	Cocke-Younger-Kasami Parsing Algorithm	Heteroassociative memory design
	SLO-2	Boundaries	Example	Illustration	Illustation	Examples
S-5	SLO-1	Training in pattern recognition systems	Nonparametric approaches-	Learning Vector Quantization,	Augmented Transition Networks, High Dimensional Grammars,	Hebbian learning
	SLO-2	Learning in pattern recognition systems	Density estimation	Example	Example	Example
S-6	SLO-1	Pattern recognition approaches	Parzen Windows	Formal Characterization of General Clustering Procedures	Stochastic Grammars and applications	Feedforward Network Architecture, Training in Feedforward networks,
	SLO-2	Statistical pattern recognition, Example	k-nn Nonparametric estimation	Explanation on procedure	Example	Explanation
S-7	SLO-1	Syntactic pattern recognition	Nearest Neighbor Rule	Clustering Strategies	Graph based structural representations	GDR, Derivation of Delta Rule
	SLO-2	Examples	Example	Different scenarios	Graph Isomorphism	Explanation
S-8	SLO-1	Neural pattern recognition	Linear Discrimant Functions, Fisher's Linear Discriminant	Cluster Swapping Approaches	Attributed Graphs, Match Graphs,	Backpropagation Algorithm,
	SLO-2	Comparison	Discrete and Binary Classification problems	Examples	Examples	Explanation
S-9	SLO-1	Black Box approaches	Techniques to directly obtain Linear Classifiers	Hierarchical clustering procedure	Cliques, Structural Unification using attributed graphs	Pattern Associator for Character Classification
	SLO-2	Reasoning driven pattern recognition	Illustration	Example	Examples	Example

Learning Resources	1. Robert J, Schalkoff, "Pattern Recognition: Statistical, Structural and Neural Approaches", John Wiley & Sons Inc., New York, Reprint 2014.	2. Earl Gose, Richard Johnsonbaugh, Steve Jost, "Pattern Recognition and Image Analysis", Prentice Hall of India Private Ltd., New Delhi – 110 001,1999. 3. DudaR.O.andHartP.E.,"Pattern Classification and Scene Analysis",Wiley,NewYork,1973

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 (5%)	Practice	Theory (25%)	Practice
Level 1	Remember	20%	-	15%	-	10%	-	-	-	15%	-
Level 2	Understand	20%	-	25%	-	20%	-	20%	-	25%	-
Level 3	Apply	40%	-	40%	-	30%	-	40%	-	40%	-
Level 4	Analyze	20%	-	20%	-	40%	-	40%	-	20%	-
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.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr.Deepan Raj, Visteon,Chennai	*Dr.T.Nagarajan, Professor and Head, Dept. of IT, SSN college of Engineering.*	*1. Dr. M. Thenmozhi, SRMIST*
		2. Dr.S Prabakaran, SRMIST
		3. Dr. Alice Nithya , SRMIST

Course Code	18CSE359T	Course Name	NATURAL LANGUAGE PROCESSING	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	CSE	Data Book / Codes/Standards	Nil		

Course Objectives:	The purpose of learning this course is to:
1	Teach students the leading trends and systems in natural language processing.
2	Make them understand the concepts of morphology, syntax, semantics and pragmatics of the language and that they are able to give the appropriate examples that will illustrate the above mentioned concepts.
3	Teach them to recognize the significance of pragmatics for natural language understanding.
4	Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.
5	To understand natural language processing and to learn how to apply basic algorithms in this field

Course Outcomes (CO):	At the end of this course, learners will be able to:	Learning Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
		1-6		
CO-1 :	Construct approaches to syntax and semantics in NLP	3	60	70
CO-2 :	Analyze approaches to syntax and semantic parsing with pronoun resolution	3	60	70
CO-3 :	Implement semantic role, relations and frames, including co reference resolution.	3	60	70
CO-4 :	Implement summarization, information retrieval and Machine Translation.	3	60	70
CO-5 :	Apply the knowledge of various levels of analysis involved in NLP and Implement different techniques of NLP like word Embedding, CBOW and Skip-gram	3	60	70

Program Outcomes (PO)												PSO		
1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
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
3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3	2	-	3	-	-	-	-	-	-	-	-	-	-	-
3	2	2	3	-	-	-	-	-	-	-	-	-	-	-
3	3	2	2	-	-	-	-	-	-	-	-	-	-	-
3	2	2	2	-	-	-	-	-	-	-	-	-	2	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Introduction to Natural Language Processing	Syntax Parsing	Semantic Relations	Information Extraction and its approaches	Introduction to Probabilistic Approaches
	SLO-2	Steps – Morphology – Syntax – Semantics	Dependency Parsing	Semantic Role Labeling		Statistical Approaches to NLP Tasks
S-2	SLO-1	Morphological Analysis (Morphological Parsing)	Semantics	Semantic Frames	Information Retrieval	Sequence Labeling
	SLO-2	Stemming – Lemmatization	Semantic Parsing	Ontology and Semantics		
S-3	SLO-1	Parts of Speech Tagging	Word Sense Disambiguation	Semantic Network and Knowledge Graph	Semantic Search	Problems - Similarity Measures
	SLO-2					
S-4	SLO-1	Approaches on NLP Tasks (Rule-based, Statistical, Machine Learning)	Lexical Disambiguation	Intent Detection and Classification	Summarization	Word Embeddings
	SLO-2				Extractive Vs Abstractive, Summarization	
S-5	SLO-1	N-grams	Structural Disambiguation	Paraphrase Extraction	Information Fusion	CBOW
	SLO-2					
S-6	SLO-1	Multiword Expressions	Word, Context and Sentence-level Semantics	Discourse	Single and Multi-document	Skip-gram
	SLO-2			Coreference Resolution	Summarization – Question Answering	
S-7	SLO-1	Collocations (Association Measures, Coefficients and Context Measures)	Pronoun Resolution	Text Coherence	Introduction to Chatbot Applications	Sentence Embeddings
	SLO-2				Retrieval based- Conversation based	
S-8	SLO-1	Vector Representation of Words	Semantic Representation of text	DiscourseStructure	NLU and NLG	Recurrent Neural Networks (RNN)
	SLO-2			Coherence		
S-9	SLO-1	Language Modeling	Introduction to Semantic Relations	Discourse Planning	Machine Translation	Long Short-Term Memory (LSTM)

Learning Resources	1. *DanielJurafskyandPrenticeHallJamesHMartin,‖SpeechandLanguageProcessing:An introductionton NaturalLanguage Processing, Computational Linguistics and Speech Recognition‖, Prentice Hall, 2nd Edition,2018.* 2. *C.Manning and H.Schutze, —Foundations of Statistical Natural Language Processing‖, MIT Press. Cambridge,MA:,1999*	3. *JamesAllen,Bejamin/cummings,—NaturalLanguageUnderstanding‖,2ndedition,1995* 4. *YoavGoldberg,Neural Network Methods for Natural Language Processing.* 5. *http://mccormickml.com/2106/04/19/word2vec-tutorial-the-skip-gram-model/* 6. *https://nlp.stanford.edu/pubs/glove.pdf*

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%*	-
Level 2	Understand	*20 %*	-	*20 %*	-	*20 %*	-	*20 %*	-	*20%*	-
Level 3	Apply	*60 %*	-	*60 %*	-	*30 %*	-	*20 %*	-	*40%*	-
Level 4	Analyze					30%		*30 %*		20%	
Level 5	Evaluate							30%			
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.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. J.Balaji, Associate Manager,Allstate Solutions Pvt Ltd, jagank.balaji@gmail.com	*1. Dr.G.Nagappan, Professor, nagappan@saveetha.ac.in*	*1.Dr.V.V.RAMALINGAM, SRMIST*

Course Code	18CSE360T	Course Name	INFORMATION STORAGE AND MANAGEMENT	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 Objective:	The purpose of learning this course is to:
CLR-1 :	Understand the components of storage infrastructure.
CLR-2 :	Gain knowledge to evaluate storage architectures including storagesubsystems
CLR-3 :	Understand the business continuity, backup and recovery methods.
CLR-4 :	Acquire knowledge on information security framework
CLR-5 :	Introduce the working principle of storage infrastructure with monitoring principles
CLR-6 :	Understand the structure of cloud computing and its techniques

Course Outcomes (CO):	At the end of this course, learners will be able to:	Learning 1 2 3		Program Outcomes (PO) 1	2	3	4	5	6	7	8	9	10	11	12	Program Specific Outcome (PSO)		
		Level of Thinking (Bloom)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design,	Modern Tool Usage	Society & Culture	Environment &	Ethics	Individual & Team	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CO-1 :	Acquire the knowledge on the components of storage infrastructure	3	80 70	3	-	-	-	-	-	-	-	2	-	-	3	-	-	-
CO-2 :	Acquire the ability to evaluate storage architectures including storagesubsystems	3	85 75	3	3	3	3	-	-	-	-	2	-	-	3	-	-	-
CO-3 :	Understand the business continuity, backup and recovery methods.	3	75 70	3	3	3	3	-	-	-	-	2	-	-	3	-	-	-
CO-4 :	Appreciate the concepts of storage security and information security applied to virtual machine	3	85 80	3	3	2	2	-	-	-	-	3	-	-	3	-	-	-
CO-5 :	Apply the knowledge for storage infrastructure	3	85 75	2	3	-	-	-	-	-	-	3	-	-	3	-	-	-
CO-6 :	Acquire the knowledge on structure of cloud computing and its techniques	3	80 70	3	-	-	-	-	-	-	-	2	-	-	3	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Introduction to Information Storage Management	Virtualization and Cloud Computing : Fiber Channel: Overview	Business Continuity And Back Up Recovery Business Continuity: Information Availability.	Storage Security And Management :	Cloud Computing:Cloud Enabling Technologies
	SLO-2	Evolution of Storage Architecture	SAN and its Evolution	BC Terminology, BC Planning life cycle	Information Security Framework	Characteristics of Cloud Computing
S-2	SLO-1	Data Centre Infrastructure	Components of FC SAN, FCConnectivity, FC Architecture	Failure Analysis, Business Impact Analysis	Risk Triad	Benefits of Cloud Computing
	SLO-2	Virtualization and Cloud Computing	IPSAN-iSCSI components	BC Technology Solutions	Storage Security Domains	Cloud Service Models
S-3	SLO-1	Key challenges in managing information.	iSCSI Protocol StackiSCSI Names	Backup and Archive: Backup Purpose	Security Implementations in Storage Networking	Cloud Deployment models
	SLO-2	Data Center Environment: Application	NAS: General Purpose Servers versus NAS Devices	Backup Considerations	Securing Storage Infrastructure in Virtualized and Cloud Environments	Cloud Infrastructure Mechanism: Logical Network Perimeter
S 4-5	SLO-1	Database Management System (DBMS)	Benefits of NAS- File Systems and Network File Sharing	Backup Granularity , Recovery considerations	RSA and VMware Security Products	Virtual Server , Cloud Storage Device
	SLO-2					
S-6	SLO-1	Host : Connectivity, Storage	Components of NAS	Backup Methods, Backup Architecture	Monitoring the Storage Infrastructure	Cloud Usage Monitor
	SLO-2	Disk Drive Components,Disk Drive Performance	NAS I/O Operation	Backup and Restore Operations	Monitoring Parameters,	Resource Replication
S-7	SLO-1	Intelligent Storage System	NAS Implementations	Backup Topologies	Components Monitored, Monitoring examples	Ready Made environment
	SLO-2	Components of an Intelligent Storage System	NAS File Sharing Protocols	Backup in NAS Environments	Storage Infrastructure Management Activities	Container
S-8	SLO-1	Storage Provisioning	Object Based Storage Devices	Backup Targets, Data Deduplication for Backup	Storage Infrastructure Management Challenges, Storage Management Examples	Cloud Challenges
	SLO-2	Types of Intelligent Storage Systems	Content Addressed Storage	Backup in Virtualized Environments	Storage Allocation to a New Server/Host,	Cloud Adoption Considerations
S-9	SLO-1	Creation of Virtual storage machine, Navigation of storage system .	Configuration and Tracing of FC scan and iSCSI scan	Sharing Files between host and Virtual Machines, Usage of Backup techniques	Creation of an Linux Instance in Public Cloud, Generate a private key, Access using SSH client	Usage of Cloud services with open source cloud tools (like Eucalyptus, Openstack, Open Nebula and others)
	SLO-2					

Learning Resources	*1. EMC Corporation, "Information Storage and Management",2nd edition Wiley India, ISBN13: 978-1118094839* *2. Thomas Erl, "Cloud Computing: Concepts, Technology & Architecture", Prentice Hall ,2013,ISBN: 9780133387568*	*3. UifTroppen Rainer Wolfgang Muller,"Storage Networks Explained", India, Wiley, 2010, ISBN13: 978-0470741436*

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%	-	15%	-	15%	-	15%	-	15%	-
Level 2	Understand	20%	-	15%	-	15%	-	15%	-	15%	-
Level 3	Apply	30%	-	40%	-	40%	-	40%	-	40%	-
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.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
	Dr.V.Masillamani	*1. Dr.B.Amutha SRMIST*
		2. Dr.A.Shanthini, SRMIST
		3. Dr. B.Kanisha SRMIST

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY
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Course Code	18CSE451T	Course Name	WIRELESS SENSOR 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	CSE	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understand basic sensor network concepts
CLR-2 :	Know physical layer issues, Medium Access Control Protocols
CLR-3 :	Comprehend network and transport layer characteristics and protocols
CLR-4 :	Understand the network management and Middleware services
CLR-5:	Acquire the knowledge on Network Security Fundamentals and Challenges

Course Outcomes (CO):	At the end of this course, learners will be able to:	Learning			Program Outcomes (PO)														
		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
CO-1 :	Understand the basic ideas about sensor network concepts with Applications and Apply the knowledge for WSN tools	2	80	85	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2 :	Acquire the knowledge on wireless transmission technology ,hardware and Medium Access Protocols	2	75	80	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-3 :	Understand the basic ideas about Wireless Sensor Networks Routing protocols and network - transport layer characteristics	2	85	80	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
CO-4 :	Apply the knowledge for network management and Middleware services	2	80	75	3	-	1	-	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Understand the Concepts of Network Security Fundamentals and Challenges	2	80	75	3	1	2	-	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Introduction to computer and wireless sensor networks	Wireless Transmission Technology and systems	Overview-Wireless Mac Protocols	Design Issues in WSN routing- Data Dissemination and Gathering	WSN middleware principles-
	SLO-2				Routing Challenges in WSN	
S-2	SLO-1	Motivation for a network of Wireless Sensor nodes -	Radio Technology Primer	Characteristics of MAC protocols in Sensor networks	Flooding	Middleware architecture
	SLO-2	Sensing and sensors	Available Wireless Technologies			Data related functions, Architecture
S-3	SLO-1	Challenges and constraints	Hardware- Telosb	Contention free MAC Protocols	Flat Based Routing – SAR	Existing middleware
	SLO-2				Directed Diffusion	MiLAN, IrisNet
S-4	SLO-1	Node architecture	Hardware -Micaz motes	MAC Protocols -Characteristics	MCFA Coherent processing	AMF,DSWare
	SLO-2	Sensing sub system		Traffic Adaptive Medium Access	Non-Coherent Processing	CLMF
S-5	SLO-1	Processor sub system	Time Synchronization- Clock	Y-MAC	Hierarchical Routing- LEACH,TEEN, APTEEN,PEGASIS	Operating systems for wireless sensor networks
	SLO-2	Communication interfaces-- prototypes		Low energy Adaptive Clustering		
S-6	SLO-1	Application of Wireless sensors	Synchronization Problems	Contention based MAC Protocols	Query Based Routing	Performance and traffic management
	SLO-2				Negotiation Based Routing	
S-7	SLO-1	WSN Tools- Overview and Limitations	Basics of time synchronization	Sensor MAC	Geographical Based Routing	Fundamentals of network security
	SLO-2		Time synchronization protocols	Timeout MAC and pattern MAC		
S-8	SLO-1	Contiki -Introduction	Localization	MAC protocols in ContikiOS simulator	Routing protocol simulation in contiki	Network security Challenges
	SLO-2		Ranging Techniques	Nullmac in Contiki simulator	RPL objective function &simulation using DGRM model cooja	
S-9	SLO-1	Characteristics of Contiki WSN simulator	Range based Localization Range Free Localization	CSMA in Contiki simulator	RPL(Routing Protocol for Low-Power and Lossy Networks) Border Router simulation in Contiki 2.7 OS	Attacks Protocols mechanisms for security
	SLO-2		Event driven Localization			

Learning Resources	1. *Kazem Sohraby, Daniel manoli , "Wireless Sensor networks- Technology, Protocols and Applications", Wiley InterScience Publications 2013.* 2. *Waltenegus Dargie, Christian Poellabauer , "Fundamentals of Wireless Sensor Networks, Theory and Practice", Wiley Series on wireless Communication and Mobile Computing, 2011* 3. *S.Swapna Kumar, "A Guide to Wireless Sensor Networks", kindle Edition, USP publications,2017* 4. *C.S Raghavendra, Krishna M.Sivalingam, Taieb znati , "Wireless Sensor Networks", Springer Science 2010.*	5. *Bhaskar Krishnamachari , " Networking Wireless Sensors", Cambridge University Press, 2005* 6. *https://www.amazon.in/Guide-Wireless-Sensor-Networks-ebook/dp/B072R53JJM* 7. *https://anrg.usc.edu/contiki/index.php/Contiki_tutorials* 8. *file:///C:/Users/Administrator.RD27/Downloads/Fundamentals-of-Wireless-Sensor-Networks-Waltenegus-Dargie.pdf*

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	15 %	-	20 %	-	20 %	-	10 %	-	10 %	-
Level 2	Understand	25 %	-	20 %	-	20 %	-	20 %	-	20 %	-
Level 3	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40 %	-
Level 4	Analyze	20%	-	20%	-	20%	-	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.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.Mr.Anirban Chowdhry, Director, Frugal Labs	1. Dr. P.T.V. Bhuvaneshwari, Professor, MIT campus, Anna University	*1. Dr. Revathi Venkatraman, SRMIST* *2. Dr.N.Snehalatha, SRMIST* *3. Dr.MB.Mukesh krishnan, SRMIST*

Course Code	18CSE452T	Course Name	NETWORK PROTOCOLS AND PROGRAMMING	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	CSE	Data Book / Codes/Standards	Nil		

Course Objectives:	The purpose of learning this course is to:
1	Describe the importance of various Internet protocols like ARP, RARP, ICMP, Multicasting and multi routing, SCTP
2	Understand the transport layer protocols , application layer protocol and its characteristics
3	Learn and Understand IPV6 technologies
4	Work with client server sockets and develop related applications to communicate with each other.
5	Understand the wide area network protocols
6	Learn the basics of MPLS protocol

Course Outcomes (CO):	At the end of this course, learners will be able to:	Learning: Level of Thinking (Bloom)	Learning: Expected Proficiency (%)	Learning: Expected Attainment (%)	PO 1 Engineering Knowledge	PO 2 Problem Analysis	PO 3 Design & Development	PO 4 Analysis, Design, Research	PO 5 Modern Tool Usage	PO 6 Society & Culture	PO 7 Environment &	PO 8 Ethics	PO 9 Individual & Team Work	PO 10 Communication	PO 11 Project Mgt. & Finance	PO 12 Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CO-1 :	Apply appropriate network layer protocols depending on the type of network	3	60	70	1	3	-	3	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Design and implement the socket programming	4	60	70	2	3	-	2	-	-	-	-	-	-	-	-	-	-	2
CO-3:	Decide on the application layer protocol to be used for a specific software	3	60	70	2	3	-	3	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Analyze and decide on the steps involved in migrating from IPv4 and IPv6	3	60	70	2	3	-	3	-	-	-	-	-	-	-	-	-	-	1
CO-5:	Identify and use the protocols applicable for Wide area networking	3	60	70	3	3	-	3	-	-	-	-	-	-	-	-	-	-	-
CO-6:	Exhibit knowledge on the MPLS protocol	3	60	70	1	3	-	3	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	IP header	Byte ordering	DNS	IPV6 Overview	DSL
	SLO-2	IP fragmentation	Byte ordering conversion functions	DNS in the Internet,	IPV6 Features	Other DSL Technology
S-2	SLO-1	ARP	System calls	DNS Resolution	IPV6 Addressing Modes	DSL Benefits
	SLO-2	RARP	Sockets	DNS Messages	IPV6 Address Types	Cable Technology
S-3	SLO-1	ICMP -introduction	System calls used with Sockets	TELNET	Introduction	Compare DSL Vs Cable
	SLO-2	ICMP-Messages	Iterative and concurrent server	SSH	Address Space Allocation	Frame Relay
S-4	SLO-1	Debugging tools	Socket Interface	FTP	Global Unicast Addresses	ATM Introduction
	SLO-2	ICMP package	Structure and Functions of Socket	TFTP	Autoconfiguration	ATM Cell Format
S-5	SLO-1	UDP Datagram	Remote Procedure Call	WWW Architecture	Renumbering	ATM Layer
	SLO-2	UDP characteristics	RPC Model, Features	WWW Documents	IPV6 Routing Protocols	AAL Layer
S-6	SLO-1	TCP Header	TCP Client Server Program	HTTP	Introduction	ATM Application
	SLO-2	TCP connection establishment process	Input, Output Processing Module	HTTP Request and Reply	IPV6 Packet Format	PPP
S-7	SLO-1	TCP Error Control	UDP Client Server Program	DHCP Operation	Comparison between IPV4 and IPV6 Header	PPP Services, Components
	SLO-2	TCP Congestion Control	UDP Control block table & Module	DHCP Configuration	IPV4 to IPV6 Tunneling	PPP frame and byte stuffing
S-8	SLO-1	TCP Flow Control	UDP Input & Output Module	SMTP	IPV4 to IPV6 Translation Techniques	HDLC
	SLO-2	Multicasting	SCTP Sockets	POP3	NAT Protocol Translation	HDLC Transfer Modes, Frame
S-9	SLO-1	Multicasting and Multicast Routing Protocol	SCTP Services and Features, Packet Format	IMAP	IPV6 Mobility	Types of HDLC Frame
	SLO-2	Stream Control Transmission Protocol	SCTP Client/Server	MIME	Protocols Changed to Support IPV6	MPLS

Learning Resources	1. *BehrouzA.Forouzan,"TCPIPProtocolSuite"4th edition,2013,McGraw-HillISBN:0073376043* 2. *DouglasE.Comer,InternetworkingwithTCP/IP,Principles,protocols,andarchitecture,Vol15th Edition,2006 ISBN: 0131876716, ISBN:978-0131876712*	3. *Richard Stevens, Unix Network Programming, vol.1, 3rd edition, 2003, McGraw-HillISBN 0-07-246060-1*

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	*60 %*	-	*40 %*	-	*60 %*	-	*60 %*	-	*60 %*	-
Level 4	Analyze			*20 %*							
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.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.Thamaraiselvam,zoho, thamaraiselvam.s@zohocorp.com	*1.Dr.Ema,Anna University Chennai,umaramesh@auist.net*	*1. Dr. G.Usha,SRMIST,Dr.J.Kalaivani,SRMIST*
2.Mr.Mithun, Cognizant,Mithun.SS@cognizant.com	*2.Dr.KunvarSingh,NITTrichy,kunwar@nitt.edu*	*2. Mr.J.GodwinPon,SRMIST*

Course Code	18CSE453T	Course Name	NETWORK ROUTING ALGORITHMS	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 Objective:	The purpose of learning this course is to:
1	Understand how addressing and routing are tied together and different architectural components are related to routing.
2	Gain knowledge on the need for routers, its functionality and different architectures.
3	Understand fundamental basis of various algorithms in centralized and distributed point of view.
4	Apply the knowledge of IP addressing in various routing algorithms.
5	Understand the various types of key routing protocols used in wireless networks.
6	Gain knowledge on past experiences and prepare for next generation networks and routing

Course Outcomes (CO):	At the end of this course, learners will be able to:	Learning: Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	PO 1 Engineering	PO 2 Problem Analysis	PO 3 Design & Analysis, Design, Research	PO 4	PO 5 Modern Tool Usage	PO 6 Society & Culture	PO 7 Environment & Sustainability	PO 8 Ethics	PO 9 Individual & Team	PO 10 Communication	PO 11 Project Mgt. &	PO 12 Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CO-1 :	Acquire the knowledge of conventional networks routing operations	4	60	70	2	-	2	-	-	-	-	-	-	-	-	2	-	-	-
CO-2 :	Comprehend Router Architectures and IP Address Lookup Algorithms	4	60	70	-	3	2	-	2	-	-	-	-	-	-	-	-	-	-
CO-3 :	Model and evaluate various routing techniques and protocols	4	60	70	-	3	2	2	-	-	-	-	-	-	-	-	-	-	1
CO-4 :	Examine how different dimensions of routing differ for different types of networks	4	60	70	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO-5 :	Apply various routing algorithms in wireless network scenario.	4	60	70	-	3	-	3	3	-	-	-	-	-	-	-	2	-	-
CO-6 :	Analyze and evaluate various routing paradigms in next generation	4	60	70	-	3	-	3	3	-	-	-	-	-	-	-	-	2	-

Duration (hour)		8	9	9	9	10
S-1	SLO-1	Network Routing: An Introduction to Routing algorithms	Router Architectures: Basic Forwarding Functions	Bellman-Ford algorithm: Centralized View	Routers, Networks, and Routing Information: Some Basics	Routing in Wireless Networks: Internet based mobile ad-hoc networking
	SLO-2	Functions of Router	Routing table versus forwarding table	Distance Vector Approach: Distributed View	Routing Table, Communication of Routing Information	Classifications of routing protocols
S-2	SLO-1	IP addressing	Types of router	Dijkstra's Algorithm	Routing Information Protocol, Version 1 (RIPv1)	Table-Driven Routing Protocols: Destination Sequenced Distance-Vector Routing Protocol
	SLO-2	On Architecture: Service Architecture	Elements of Router	Comparison of Bellman-Ford and Distance Vector Approach	Routing Information Protocol, Version 2 (RIPv2)	Cluster-Head Gateway Switch Routing Protocol
S-3	SLO-1	Protocol architecture stack	Packet Flow	Shortest Path Computation with Candidate Path Caching	Interior Gateway Routing Protocol (IGRP)	On-Demand Routing Protocols: Dynamic Source Routing Protocol
	SLO-2		Packet Processing	Widest Path Computation with Candidate Path Caching	Enhanced Interior Gateway Routing Protocol (EIGRP), Route Redistribution	Ad Hoc On-Demand Distance-Vector Routing Protocol
S-4	SLO-1	Network Topology Architecture	Shared CPU architecture, Shared forwarding Engine Architecture	Widest Path Algorithm	OSPF: Protocol Features	Hybrid Routing Protocols: Core Extraction Distributed Ad Hoc Routing Protocol
	SLO-2	Network Management Architecture	Shared Nothing Architectures, Clustered Architectures	k-Shortest Paths Algorithm	OSPF Packet Format	Zone Routing Protocol
S-5	SLO-1	Public Switched Telephone Network	Impact of Addressing on lookup	Routing Protocol, Routing Algorithm, and Routing Table	Integrated IS-IS	Routing Protocols With Efficient Flooding Mechanisms : Preferred Link-Based Routing Protocols

			Longest Prefix Matching	*Routing Information Representation and Protocol Messages*	*Similarities and Differences Between IS-IS and OSPF*	*Optimized Link State Routing*
S-6	**SLO-1**	*Communication Technologies*	*Naïve Algorithms, Binary Tries*	*Distance Vector Routing Protocol*	*IP Traffic Engineering: Traffic, Stochasticity, Delay, and Utilization*	*Hierarchical Routing Protocols*
					Applications' View	*Power-Aware Routing Protocols*
S-7	SLO-1	*Standard Committees – International Telecommunication Union*	*Multi-bit Tries*	*Link State Routing Protocol*	*Traffic Engineering: An Architectural Framework*	*Toward Next Generation Routing: Quality of Service Routing*
	SLO-2	*Internet Engineering Task Force, MFA Forum*	*Compressing multi-bit strides*		*Traffic Engineering: A Four-Node Illustration*	
S-8	SLO-1	*Type Length Value*	*Search By Length Algorithms*	*Path Vector Routing Protocol*	*BGP Operations, configuration, faces of BGP*	*Multiprotocol Label Switching(MPLS)*
	SLO-2	*Network Protocol Analyzer*	*Search By value approaches*		*BGP Decision Process*	*Generalized MPLS*
S-9	SLO-1		*Hardware Algorithms*	*Network Flow Modeling: Single-Commodity Network Flow*	*Internal BGP Scalability*	*Routing and Traffic Engineering with MPLS*
	SLO-2		*Comparing Different Approaches*	*Multicommodity Network Flow: Three-Node Example*	*Protocol Message Format*	
S-10	SLO-1					*PSTN Call Routing Using the Interne*
	SLO-2					

Learning Resources	1. *D.Medhi and K.Ramasamy, Network Routing : Algorithms, Protocols and Architectures, Morgan Kaufmann Publishers, First Edition 2007.* 2. *C.Siva Ram Murthy and B.S.Manoj, Adhoc Wireless Networks, Pearson Education, 2007.* 3. *D.Medhi and K.Ramasamy, Network Routing : Algorithms, Protocols and Architectures, Morgan Kaufmann Publishers, Second Edition 2017.*	4. *Steen Strub M, Routing in Communication networks, Prentice Hall International, 1995.* 5. *Internetworking Technologies Handbook, Inc. Cisco Systems, ILSG Cisco*

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%	-	15%	-	15%	-	20	-	15%	-
Level 2	Understand	20%	-	25%	-	25%	-	20	-	25%	-
Level 3	Apply	45%	-	40%	-	40%	-	30	-	30%	-
Level 4	Analyze	15%	-	20%	-	20%	-	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.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. T.Bernald , Senior Consulatant , TCS Chennai. bernald.t@tcs.com (waiting for approval)	*Dr.Hariharan Muthusamy, NIT, hariharanm@nituk.ac.in*	1. *Dr.Femilda Josephin J S, SRMIST*
		2. *Mr.Rajesh Babu, SRMIST*
		3. *Mr. J.Godwin, SRMIST*

Course Code	18CSE454T	Course Name	HIGH PERFORMANCE COMPUTING	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 Engineering	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*To learn about Modern Processors and concepts*			
CLR-2 :	*To understand the basic concepts of optimizations*			
CLR-3 :	*To learn about Parallel Computers and programming*			
CLR-4 :	*To understand the basic concepts of parallelization*			
CLR-5 :	*To Study about Memory Parallel Programming using OpenMP*			
CLR-6 :	*To Study about Memory Parallel Programming using and MPI*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	*Acquire the knowledge of Modern processors and concepts*	*2*	*80*	*85*
CLO-2 :	*Understand the basic ideas about Optimizations*	*2*	*75*	*80*
CLO-3 :	*Acquire the ability to identify parallel computers*	*2*	*85*	*80*
CLO-4 :	*Appreciate the concepts of parallelization*	*2*	*80*	*75*
CLO-5 :	*Apply the knowledge on parallel programming using Open MP*	*2*	*75*	*85*
CLO-6 :	*Acquire the knowledge on parallel programming using MPI*	*2*	*80*	*85*

		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 :	*Acquire the knowledge of Modern processors and concepts*	*3*	*3*		-	-		-	-	-	*3*	-	-	-	-	-
CLO-2 :	*Understand the basic ideas about Optimizations*	-	*3*	-	-	-	-	-	-	-	-	-	-	-	-	*3*
CLO-3 :	*Acquire the ability to identify parallel computers*	-	-	*3*	-	-	-	-	*2*	-	-	*1*	-	-	-	-
CLO-4 :	*Appreciate the concepts of parallelization*	-	*3*	-	-	*3*	-	-	-	*3*	-	-	*3*		-	-
CLO-5 :	*Apply the knowledge on parallel programming using Open MP*	-	-	-	*3*	-	*1*	*1*	-	-	-	-	-	-	-	-
CLO-6 :	*Acquire the knowledge on parallel programming using MPI*	-	-	-	-	-	-	-	-	-	-	-	-	*3*	*3*	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Stored Program Computer Architecture*	*Scalar profiling- Function- and line-based runtime profiling*	*Taxonomy of parallel computing paradigms*	*Introduction to OpenMP*	*Distributed-memory parallel programming with MPI- Message passing*
	SLO-2	*General-ptupose cache-based microprocessor architecture*	*Hardware performance counters .*	*Shared-memory computers*	*Parallel execution*	*introduction to MPI*
S-2	SLO-1	*Performance based metrics and Benchmarks*	*Manual instrumentation*	*Cache coherence*	*Data scoping*	*Messages and point-to-point Communication, Collective Communication*
	SLO-2	*Transistors galore:*	*Common sense optimizations- Do less work!*	*UMA – ccNUMA*	*OpenMP worksharing for loops*	*Nonblocking point-to-point Communication*
S-3	SLO-1	*Moore's Law*	*Avoid expensive operations!*	*Distributed-memory computers*	*Synchronization*	*Virtual topologies*
	SLO-2	*Pipelining*	*Shrink the working set!*	*Hierarchical (hybrid) systems*	*Reductions*	*Example: MPI parallelization of a Jacobi solver*
S-4	SLO-1	*Superscalarity*	*Simple measures, large impact- Elimination of common subexpressions*	*Networks- Basic performance characteristics of networks*	*Loop scheduling, Tasking*	*MPI implementation*
	SLO-2	*SIMD*	*Avoiding branches*	*Buses, Switched and fat-tree networks*	*Miscellaneous*	*Performance properties, MPI performance tools*
S-5	SLO-1	*Memory hierarchies*	*Using SIMD instruction sets*	*Mesh networks, Hybrids*	*Case study: OpenMP-parallel Jacobi algorithm*	*Communication parameters*
	SLO-2	*Cache*	*The role of compilers*	*Parallelism- Data parallelism*	*Advanced OpenMP: Wavefront parallelization*	*Synchronization, serialization, contention*
S-6	SLO-1	*Cache mapping*	*General optimization options*	*Functional parallelism*	*Efficient OpenMP programming*	*Implicit serialization and synchronization*
	SLO-2	*Prefetch*	*Inlining, Aliasing*	*Parallel scalability*	*Profiling OpenMP programs*	*Contention*
S-7	SLO-1	*Multicore processors*	*Computational accuracy*	*Factors that limit parallel execution*	*Performance pitfalls*	*Reducing Communication overhead*
	SLO-2	*Multithreaded processors*	*Register optimizations, Using compiler logs*	*Scalability metrics, Simple scalability laws*	*Ameliorating the impact of OpenMP worksharing constructs*	*Optimal domain decomposition*
S-8	SLO-1	*Vector processors-*	*C++ optimizations- Temporaries*	*Parallel efficiency, Serial performance versus strong scalability*	*Determining OpenMP overhead for short loops*	*Aggregating messages*
	SLO-2	*Design principles*	*Dynamic memory management*	*Refined performance models*	*Serialization*	*Collective Communication*
S-9	SLO-1	*Maximum performance estimates*	*Loop kernels and iterators*	*Choosing the right scaling baseline*	*False sharing*	*Nonblocking vs. asynchronous Communication,*
	SLO-2	*Programming for vector architectures*	*Storage order- Case study: Jacobi algorithm and Dense matrix transpose.*	*Load imbalance*	*Case study: Parallel sparse matrix-vector multiply*	*Understanding intranode point-to-point Communication*

Learning Resources	
	1. *GeorgHager, GerhardWellein,"IntroductiontoHighPerformanceComputingforScientistsand Engineers", Chapman&Hall/CRCComputationalScienceseries,2011.*
	2. *JohnLevesque,GeneWagenbreth,"HighPerformanceComputing:Programmingand Application"CRC Press,2010*
	3. *KaiHwang,Zhiweixu"ScalableParallelComputing:Technology,Architecture,Programming",*
	4. *CharlesSeverance,KevinDowd,"HighPerformanceComputing", O'ReillyMedia,2ndEdition,1998.*

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 (5%)	Practice	Theory (25%)	Practice
Level 1	Remember	20%	-	15%	-	10%	-	-	-	15%	-
Level 2	Understand	20%	-	25%	-	20%	-	20%	-	25%	-
Level 3	Apply	40%	-	40%	-	30%	-	40%	-	40%	-
Level 4	Analyze	20%	-	20%	-	40%	-	40%	-	20%	-
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.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. *Mr.Kesavan, HCL Technologies*	*1. Dr. Surendran Rajendran, AMA International University, Bahrain*	*1. J. Godwin Ponsam, SRMIST*
2. *Mr.R.Celein , Symmantec India Limited*		*2. Mr.SivakumarSRMIST*
		3.. Mr. Jothikumar, SRMIST

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY
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Course Code	18CSE455T	Course Name	DATABASE SECURITY AND PRIVACY	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	CSE	Data Book / Codes/Standards		Nil	

Course Objectives	*The purpose of learning this course is to:*
1	*Understand the fundamentals of security relates to information*
2	*Comprehend how security is maintained in information systems*
3	*Understand the concept of security models in database*
4	*Implementation of virtual private database*
5	*Learn the procedures of database auditing*
6	*Implementation of data mining algorithms for PPDM*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning 1-6: Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Program Outcomes (PO) 1	2	3	4	5	6	7	8	9	10	11	12	Program Specific Outcome (PSO) 1	2	3
					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 :	*Acquire the knowledge of information system and information security*	*4*	*60*	*70*	*3*	-	-	-	-	-	-	-	-	-	-	-	*3*	-	-
CLO-2 :	*Exhibit knowledge to handle security of databases*	*4*	*60*	*70*	*3*	*3*	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	*Design and develop the security model in database*	*4*	*60*	*70*	*3*	-	-	-	-	-	-	-	-	-	-	-	-	-	*3*
CLO-4 :	*Implement VPD in various databases*	*4*	*60*	*70*	*3*	*3*	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	*Audit the database activities, users, security*	*4*	*60*	*70*	*3*	-	-	*3*	-	-	-	-	-	-	-	-	-	*3*	-
CLO-6 :	*Apply the security mechanism in PPDM using various algorithms*	*4*	*60*	*70*	*3*	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Security Architecture: Introduction*	*Administration of Users-Introduction*	*Database Application Security Models: Introduction-*	*Auditing Database Activities-introduction*	*Privacy Preserving Data Mining Techniques: Introduction*
	SLO-2	*Information Systems*	*Authentication*	*Types of Users*	*Oracle Database Activities*	*Data Mining Techniques:*
S-2	SLO-1	*Database Management Systems*	*Creating Users*	*-Security Models*	*Oracle Database Activities*	*Privacy Preserving Data Mining Algorithms*
	SLO-2	*Information Security Architecture*	*SQL Server User*	*Application Types*	*Creating DLL Triggers with Oracle*	*Privacy Preserving Data Mining Algorithms*
S-3	SLO-1	*- Database Security*	*Removing, Modifying Users*	*-Application Security Models*	*Creating DLL Triggers with Oracle*	*General Survey-Data Mining Techniques*
	SLO-2	*Asset Types and value*	*Default users*	*Data Encryption*	*Auditing Database Activities with Oracle*	*Randomization Methods*
S-4	SLO-1	*Security Methods*	*Remote Users*	*Virtual Private Databases: Introduction*	*Auditing Database Activities with Oracle*	*Randomization Methods*
	SLO-2	*Operating System Security Fundamentals: Introduction*	*Database Links*	*-Overview of VPD*	*Auditing Server Activity with SQL Server 2000*	*Group Based Anonymization*
S-5	SLO-1	*Operating System Overview*	*Linked Servers*	*Implementation of VPD using Views*	*Auditing Server Activity with SQL Server 2000*	*Group Based Anonymization*
	SLO-2	*Security Environment*	*Remote Servers*	*Application Context in Oracle*	*Auditing Server Activity with SQL Server 2000*	*Distributed Privacy Preserving Data Mining*
S-6	SLO-1	*Security Components*	*Practices for Administrators and Managers-*	*Implementing Oracle VPD-*	*Auditing Server Activity with Oracle*	*Distributed Privacy Preserving Data Mining*
	SLO-2	*Authentication Methods*	*Profiles, Password Policies, Privileges and Roles: Introduction*	*Implementing Oracle VPD*	*Auditing Server Activity with Oracle*	*Curse of Dimensionality*
S-7	SLO-1	*User Administration*	*Defining and Using Profiles*	*Viewing VPD Policies*	*Security and Auditing*	*Application of Privacy Preserving Data Mining*
	SLO-2	*Password Policies*	*Designing and Implementing Password Policies*	*VPD using views*	*Security and Auditing*	*Application of Privacy Preserving Data Mining*
S-8	SLO-1	*Vulnerabilities*	*Best Practices*	*Application contexts using Data Dictionary*	*Casestudy: projest security and auditing*	*Casestudy: on PPDM*
	SLO-2	*Vulnerabilities*	*Granting and Revoking User Privileges*	*Policy manager implementation*	*Casestudy: projest security and auditing*	*Casestudy: on PPDM*
S-9	SLO-1	*Email Security*	*Creating, Assigning and Revoking User Roles*	*Policy Manager Implementing Row and Column level Security with SQL Server*	*Casestudy: projest security and auditing*	*Casestudy: on PPDM*
	SLO-2	*Internet security*	*Best practices*	*Policy Manager Implementing Row and Column level Security with SQL Server*	*Casestudy: projest security and auditing*	*Casestudy: on PPDM*

Learning Resources	1. HassanA.Afyouni,"DatabaseSecurityandAuditing",ThirdEdition,CengageLearning,2009. 2. RonBenNatan,"ImplementingDatabaseSecurityandAuditing",ElsevierDigitalPress,2005	3. Charu C. Aggarwal, Philip S Yu, "Privacy Preserving Data Mining": Models and Algorithms, Kluwer Academic Publishers, 2008

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 (25%)	Practice
Level 1	Remember	20%	-	10%	-	10%	-	10%	-	10%	-
Level 2	Understand	20%	-	25%	-	30%	-	25%	-	20%	-
Level 3	Apply	40%	-	40%	-	30%	-	30%	-	35%	-
Level 4	Analyze	20%	-	25%	-	30%	-	35%	-	35%	-
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.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.Somu Chockalingam, Founder and President,Doyensys,Chennai	Dr.K.Vivekanandan,Professor, Pondicherry Engineering College	1. Dr. B. Muruganantham,SRMIST
		2.. Dr.M.Thenmozhi,SRMIST
		3.. Ms.M.Maheswari,SRMIST

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY
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Course Code	18CSE456T	Course Name	SOFTWARE DEFINED 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	CSE	Data Book / Codes/Standards		-	

Course Objectives	*The purpose of learning this course is to:*
1	*Gain knowledge on technologies associated with Software Defined Networks (SDN)*
2	*Integration of SDN Controller with various Mininet Programming Techniques*
3	*Appraise on various APIs available to be used with SDN*
4	*Learn various existing networking technologies that could be used with SDN*
5	*Gain knowledge on the existing open source techniques and prepare an article about SDN*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)												PSO		
		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,	Modern Tool Usage	Society & Culture	Environment &	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CO-1 :	*Exhibit knowledge on fundamental technologies of SDN*	*3*	*60*	*70*	3	-	3	-	-	-	-	-	-	-	-	-	-	2	-
CO-2 :	*Decide on and use appropriate Mininet Programming and integrate SDN controllerSummarize the SDN basis, the API's integrated as centralized networks and SDN controller.*	*3*	*60*	*70*	-	2	-	-	2	-	-	-	-	-	-	-	-	-	-
CO-3 :	*Demonstrate ability to use API's to provide various services in SDN.*	*3*	*60*	*70*	2	-	1	-	-	-	-	-	-	-	-		1	-	-
CO-4 :	*Expound different protocols and application based SDN model and network function based on various networks applications.*	*3*	*60*	*70*	2	-	-	3	-	-	-	-	-	-	-		-	-	-
CO-5 :	*Analyze the economics of SDN and its impacts in the market place via open daylight and open stack.*	*3*	*60*	*70*	2	-	-	-	2	-	-	-	-	-	-	-		-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Introduction*	*Why SDN? Genesis of SDN*	*Alternative definitions of SDN*	*Emerging SDN Models*	*SDN Ecosystem*
	SLO-2	*How to Read a Paper (S. Keshav)*	*How SDN Works*	*Potential drawbacks of Open SDN*	*Protocol Models: NETCONF, BGP, MPLS*	*White-box switching*
S-2	SLO-1	*Ho to Review a Paper (Timothy Roscoe), How to Disagree (Paul Graham)*	*SDN Evolution, SDN Basics*	*SDN via APIs*	*Controller Models*	*Open Sourcing SDN*
	SLO-2	*Networking Basics: Switching, Addressing, Routing*	*SDN Architecture*	*SDN via Hypervisor-Based Overlays*	*Application Models: Proactive, Declarative, External*	*Open Networking Foundation*
S-3	SLO-1	*Paper Reading: 4D*	*Plane Separation*	*SDN via Opening Up the Device*	*SDN in Data Centers: Multitenancy, Failure Recovery*	*OpenDaylight*
	SLO-2	*Paper Reading: 4D*	*Simple Device and Centralized Control*	*Building our own SDN Switch*	*SDN in Internet eXchange Points (IXPs)*	*The ONOS Project*
S-4	SLO-1	*Paper Reading: ALF*	*Network Automation and Virtualization*	*SDN on Raspberry Pi, Zodiac Fx*	*Tunneling and Path Technologies, Ethernet Fabrics in the Data Center*	*Hypervisors: Background, Types*
	SLO-2	*Paper Reading: ALF*	*Openness, Northbound and Southbound APIs*	*Ryu on Raspberry Pi, Zodiac Fx*	*SDN Use Cases, Open SDN versus Overlays in the Data Center*	*OpenStack Deployment*
S-5	SLO-1	*Switching Architecture: Data, Control, and Management Planes*	*Paper Reading: OpenFlow: Enabling Innovation in Campus Networks*	*Network Function Virtualization (NFV)*	*Real-World Data Center Implementations, SDN in Other Environments*	*OpenStack Orchestration*
	SLO-2	*Hardware Lookup*	*Review 1*	*Review 2*	*Review 3*	*Review 4*
S-6	SLO-1	*Forwarding Rules*	*OpenFlow, Switch-Controller Interaction*	*SDN vs. NFV*	*Wide Area Networks*	*OpenSwitch*
	SLO-2	*Dynamic Forwarding Tables*	*Flow Table, Packet Matching*	*OPNFV*	*Paper Reading: B4: Experience with a Globally-Deployed Software Defined WAN, SIGCOMM, 2013*	*Reactive versus Proactive Applications*
S-7	SLO-1	*Autonomous Switches and Routers*	*Actions and Packet Forwarding*	*Service Creation and Chaining*	*Service Provider and Carrier Networks*	*Analyzing Simple SDN Applications*
	SLO-2	*Internet Architecture*	*Extensions and Limitations*	*NFV Orchestration*	*Campus Networks*	*Other SDN Applications*

S-8	SLO-1	*Control-Data Plane Separation*	*Paper Reading: P4: Programming Protocol-IndependentPacket Processors*	*Creating Network Virtualization Tunnels*	*Hospitality Networks, Mobile Networks*	*Future of SDN*
	SLO-2	*Packet Scheduling*	*SDN Controllers: POX, RyuMininet Programming*	*Offloading Flows in the Data Center*	*In-Line Network Functions*	*SDN Security*
S-9	SLO-1	*Paper Reading: The Road to SDN: An Intellectual History of Programmable Networks*	*SDN Controllers: OpenDaylight, Mininet Programming*	*Access Control for the Campus*	*Optical Networks*	*Use Cases*
	SLO-2	*Project Proposal Due*	*SDN Controllers: ONOS, Mininet Programming*	*Traffic Engineering for Service Providers*	*SDN vs. P2P/Overlay Networks*	*Group Project Presentation*

Learning Resources	1. *Software Defined Networks: A Comprehensive Approach, 2nd Edition Morgan Kaufmann, 2016* 2. *SDN: Software Defined Networks, Thomas D. Nadeau, Ken Gray, O'Reilly Media, 2013.*	3. *Network Function Virtualization, Ken Gray, Thomas D. Nadeau, Morgan Kaufmann, 2016*

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	*60 %*	-	*60 %*	-	*60 %*	-	*60 %*	-	*60 %*	-
Level 4	Analyze										
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.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		1. *Dr. Femilda*
		2. *Mr. K. Venkatesh*
		3. *Mr. Karthick Nanmaran*

Course Code	18CSE457T	Course Name	SEMANTIC WEB	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 Objective:	*The purpose of learning this course is to:*
1.	*Understand the Semantic Web essentials with RDF and XML Technologies*
2.	*Understand how semantic technologies promote data portability by using SPARQL*
3.	*Learn the methodologies used in web ontology using OWL*
4.	*Learn the uses of SWRL, RIF concepts to enrich web application development*
5.	*Use the concept of the semantic web technology in E Commerce applications*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Learning			Program Outcomes (PO)														
		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
CO-1 :	*Apply flexible approach for describing resources on web and interchanging of data using RDF and XML*	*5*	*70*	*75*	*2*	*-*	*3*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
CO-2 :	*Design standard in Query structure using SPARQL provide the data portability*	*4*	*70*	*75*	*3*	*2*	*-*	*3*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*2*
CO-3 :	*Know about ontology management and tools used for Ontology annotation using OWL*	*4*	*70*	*75*	*2*	*3*	*-*	*-*	*3*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
CO-4 :	*Develop an application to find, share, and combine data on the Web using SWRL and RIF*	*4*	*70*	*75*	*3*	*-*	*3*	*2*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*2*
CO-5	*Identify the Semantic web architectures and challenges in building Ecommerce applications*	*4*	*70*	*75*	*3*	*-*	*-*	*-*	*3*	*-*	*-*	*-*	*-*	*-*	*1*	*-*	*-*	*-*	*-*

Duration (hour)		9	9	9	9	9
S-1	**SLO-1**	*The Semantic Web Vision*	*Querying the Semantic Web*	*Web Ontology Language*	*Logic and Inference: Rules*	*Applications*
	SLO-2	*Motivation for the Semantic Web*	*SPARQL Infrastructure*	*Requirements for Ontology Languages*	*Logic and Rules*	*e-commerce*
S-2	**SLO-1**	*Semantic Web Technologies*	*Matching Patterns*	*OWL Syntax*	*Rules on the Semantic Web*	
	SLO-2	*Explicit Metadata*		*Formal Semantics*	*Monotonic Rules*	*Adoption*
S-3	**SLO-1**	*Ontologies*	*Filters*	*Expressivity*	*Monotonic Rules: Syntax*	*Publication*
	SLO-2	*RDF,OWL*			*Rules, Facts*	*News website application*
S-4	**SLO-1**	*Logics-Principles of reasoning*	*Constructs for Dealing with an Open World*		*Logic Programs*	*Adoption*
	SLO-2	*The Semantic Web versus Artificial Intelligence*		*Reasoning Support*	*Monotonic Rules: Semantics*	*Publication*
S-5	**SLO-1**	*A Layered Approach*	*Organizing Result Sets*	*Compatibility of OWL2 with RDF/RDFS*	*Predicate Logic Semantics*	*Constructing Ontologies Manually*
	SLO-2			*OWL2 Full: RDF-Based Semantics*	*OWL2 RL*	*Reusing Existing Ontologies*
S-6	**SLO-1**	*RDF: Data Model*	*Other Forms of SPARQL Queries*	*OWL2 DL: Direct Semantics*		
	SLO-2				*Rule Interchange Format: RIF*	*Semiautomatic Ontology Acquisition*
S-7	SLO-1	*RDF/XML*	*Querying Schemas*	*The OWL2 primitives*	*RIF-BLD*	
	SLO-2	*RDFS: Adding Semantics*		*OWL2 Syntax*	*Compatibility with RDF and OWL Semantic Web Rules Language (SWRL)*	*Ontology Mapping*
S-8	SLO-1	*Classes and Properties*	*Adding Information with SPARQL Update*	*OWL2 Property Types*		
	SLO-2	*Class Hierarchies and Inheritance*	*Inserting and Loading Triples*	*OWL2 Property Axioms*		
S-9	SLO-1	*Property Hierarchies*	*Deleting Triples*	*OWL2 Class Axioms*	*Rules in SPARQL: SPIN*	*SemanticWeb Application Architecture*
	SLO-2	RDF Schema	Case study	Individual Facts	RuleML	

Learning Resources	1. *Grigoris Antoniou and Frank Van Harmelen,-A Semantic Web Primer - The MIT Press, Cambridge, Massachusetts London, England, Edition 3,2012* 2. *Toby Segaran, Colin Evans, Jamie Taylor, Programming the Semantic Web Build Flexible Applications with Graph Data, O'Reilly Media,2009*	3. *John Hebeler , Matthew Fisher, Ryan Blace, Andrew Perez-Lopez , Mike Dean Semantic Web Programming, 1st Edition,Wiley, 2009.* 4. *Thomas B. Passin, Explorer's Guide to the Semantic Web, Manning, 2004*

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%*	-	*15 %*	-	*20 %*	-		-	*15%*	-
Level 2	Understand	*20 %*	-	*25 %*	-	*20 %*	-	*20 %*	-	*25%*	-
Level 3	Apply	*40%*	-	*40 %*	-	*30 %*	-	*30 %*	-	*40%*	-
Level 4	Analyze	20%	-	20%	-	30%	-	30%	-	20%	-
Level 5	Evaluate	-	-	-	-	-	-	20%	-	-	-
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.,

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.C.N.Subalalitha***
		Ms.S.Veena

Course Code	18CSE458T	Course Name	WIRELESS AND MOBILE COMMUNICATION	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 Objectives:	*The purpose of learning this course is to:*
1	*Apply the various techniques for analog and digital communication*
2	*Analyze the fundamentals of cellular systems*
3	*Differentiate the various types of cellular standard by their unique services.*
4	*Apply skills in various Routing protocols*
5	*Comprehend the concept of mobile network, transport layer and wireless technologies*

Course Learning Outcomes (CO):	*At the end of this course, learners will be able to:*	Learning			Program Outcomes (PO)												Program Specific Outcomes (PSO)		
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12			
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Research, Analysis, Design,	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CO-1 :	*Exhibit knowledge on fundamental concepts of Wireless Technology*	*4*	*60*	*70*	*3*	*2*	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2 :	*Demonstrate ability to identify the Digital Cellular Standards used for communication*	*4*	*60*	*70*	*2*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-3 :	*Analyze and use appropriate cellular standards based on requirements*	*4*	*60*	*70*	*2*	-	-	-	-	-	-	-	-	-	-	-	-	-	*2*
CO-4 :	*Conceive operation of mobile Routing protocols*	*4*	*60*	*70*	*3*	-	*1*	-	-	-	-	-	-	-	-	-	-	-	-
CO-5 :	*Manifest knowledge on various emerging wireless technologies*	*4*	*60*	*70*	*3*	*1*	*2*	-	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		11	9	9	9	7
S-1	SLO-1	Introduction to wireless Communication	Cellular Concept	Introduction to GSM	Mobile IP	IEEE 802.11
	SLO-2	*Elements of wireless Communication system*	*Cell area*	*Frequency Bands and Channels*	*IP packet delivery*	*System Architecture*
S-2	SLO-1	*Frequencies for radio Communication*	*Signal strength*	*Frames in GSM*	*Tunneling – Reverse Tunneling*	*Protocol Architecture*
	SLO-2	*Signals, Noise – Types of Noise*	*Cell parameter*	*Planes and layers of GSM*	*IPv6*	*MAC Layer and Management*
S-3	SLO-1	*Introduction to modulation and demodulation*	*Capacity of Cell*	*Protocols*	*DHCP*	*802.11a, 802.11b*
	SLO-2	*Signals in the modulation*	*Co channel interference*	*Localization and calling*	*Tradition TCP*	*HIPERLAN*
S-4	SLO-1	*Introduction to Analog modulation schemes*	*Frequency reuse*	*Handoff – Short messaging system*	*Congestion control*	*Bluetooth Architecture*
	SLO-2	*Amplitude Modulation Frequency modulation*	*Cell splitting Cell sectoring*	*GPRS EDGE*	*Classical TCP Snooping ,*	*IEEE 802.15* *IEEE 802.15.4*
S-5	SLO-1	*Phase Modulation Introduction to Analog modulation schemes*	*Multiple Radio access protocols Frequencydivision Multiple Access*	*3G CELLULAR SystemsMMS*	*Mobile TCPFast retransmit / Fast recovery*	*MANET characteristicsROUTING*
	SLO-2	*Amplitude Shift Keying Frequency Shift Keying Phase Shift Keying- BPSK, QPSK*	*Time division Multiple Access Fixed ALOHA , Slotted ALOHA*	*UMTS Release and standards UMTS system architecture UTRAN*	*Transaction oriented TCP TCP over 2.5/3G wireless Networks*	*AODV Routing VANETCommunications in VANET*
S-6	SLO-1	*Multiplexing and multiple access techniques*	*Multiple Access with Collision Avoidance*	*Handover*	*Introduction to WAP WAP Architecture*	*Wireless Sensor Networks*
	SLO-2					
S-7	SLO-1	*Frequency-division multiplexing*	*Space division Multiple Access Code division Multiple Access*	*Satellite System Infrastructure- GEO, LEO, MEO*	*Wireless Datagram ProtocolWireless Transaction Protocol*	*RFID TechnologyTwo tags of RFID*
	SLO-2	*Time-division multiplexing*	*Spread ALOHA multiple Access*	*Limitations of GPS*	*Wireless Session Protocol*	*Wi-Fi Standards*
S-8	SLO-1	*Code-division multiplexing*	*OFDM*	*GPSBeneficiaries of GPS*	*Wireless Transport Layer Security*	*WiMax Standards*
	SLO-2	*Spread spectrum modulation*	*Variants of OFDM*			
S-9	SLO-1	*frequency hopping Spread spectrum*	*Comparison of Multiple Access Technique*	*4G Cellular systems*	*Wireless Markup Language*	*Fem-to-Cell Network*
	SLO-2	*Direct Sequence Spread spectrum*		*4G Standards(LTE/Wimax)*	*Push Architecture*	*Push-to-talk technology for SMS*

Learning Resources

1. Roy Blake, Wireless Communication Technology‖ CENGAGE learning, Sixth indian reprint 2013.
2. Dharma Prakash Agarwal, Qing-An Zeng , —Introduction to Wireless and Mobile Systems‖ CENGAGE learning, First edition 2014.
3. Jochen Schiller, —Mobile Communications‖, Addision Wesley, 2nd edition 2011.
4. Singal TL, —Wireless Communication‖, Tata McGraw Hill Education Private Limited.
5. G.I.Papadimitriou, A.S.Pomportsis, P.Nicopolitids, M.S.Obaidat, —Wireless Networks‖, John Wiley and Sons, 2003
6. GrayJ.Mullet —Wireless TeleCommunication System and Networks‖, CENGAGE learning, reprint 2014.
7. UpenaDalal, —Wireless Communication‖ Oxford University Press, First edition 2009.
8. KavehPahlavan& Prashant Krishnamurthy, —Wireless Networks‖ PHI 2002.
9. Martyn Mallick, —Mobile and Wireless Design Essentials‖, Wiley Dreamtech India Pvt.Ltd., 2014.

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	15 %	-	20 %	-	20 %	-	10 %	-	10 %	-
Level 2	Understand	25 %	-	20 %	-	20 %	-	20 %	-	20 %	-
Level 3	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40 %	-
Level 4	Analyze	20%	-	20%	-	20%	-	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.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr.MadanLakshmanan	Prof. SubraGanesan	Dr.S.Suresh
Senior Scientist	Professor, Electrical and Computer Engineering	Mrs.Jeya
CEERI, CSIR, Chennai (R&D Industry)	Oakland University, USA	Mr.H.Karthikeyan

Course Code	18CSE459T	Course Name	SERVICE ORIENTED ARCHITECTURE	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 Objectives:	*The purpose of learning this course is to:*
CLR-1 :	*Learn service oriented analysis techniques*
CLR-2 :	*Learn technology underlying the service design*
CLR-3 :	*Learn advanced concepts in building SOA*
CLR-4 :	*Understand the Java Web services*
CLR-5 :	*To know about various Web services specification standards*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CO-1 :	*Demonstrate knowledge on service oriented design technology*	3	60	70
CO-2 :	*Develop the web services in SOA*	3	60	70
CO-3 :	*Express knowledge on advanced concepts of SOA*	3	60	70
CO-4 :	*Exhibit Proficiency in Java web services*	3	60	70
CO-5 :	*Apply knowledge on ASP .NET to develop web services*	3	60	70

Program Outcomes (PO)												PSO		
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	PSO - 1	PSO - 2	PSO – 3
3	-	1	-	-	-	-	-	-	-	-	-	2	-	-
3	3	-	-	2	-	-	-	-	-	-	-	3	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	3
3	-	-	-	-	-	-	-	-	-	-	-	-	-	2
3	1	-	-	2	-	-	-	-	-	-	-	-	3	-
3	-	-	-	-	-	-	-	-	-	-	-	-	3	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Introduction to SOA , Defining SOA*	*Introduction to Web Services*	*Phases of the SOA delivery lifecycle*	*SOA support in J2EE*	*Introduction to WS-BPEL*
	SLO-2	*Necessity of SOA.*	*Primitive SOA*	*SOA Delivery Strategies Top- down strategy, Bottom-up strategy*	*SOA platform basics and building blocks*	*Basic terms used in the BPEL terminology*
S-2	SLO-1	*SOA timeline from XML to Web services to SOA*	*Web Service Framework with respect to SOA*	*Agile strategy with Pros and cons*	*Overview of Java API for XML-based web services (JAX-WS)*	*WS-Coordination overview*
	SLO-2	*History about XML*	*Logical components of the Web services framework*	*Objectives and service-oriented process steps*	*Java Architecture for XML binding (JAXB)*	*WS-Choreography*
S-3	SLO-1	*Web Services and SOA*	*Service descriptions with WSDL layout*	*Benefits of a business-centric SOA*	*Building web services and client with examples*	*WS-Policy with SOA*
	SLO-2	*Service Oriented Enterprise (SOE)*	*Meta data and service contracts*	*Service- oriented design*	*Introduction to Java API for XML Registries(JAXR)*	*WS Security*
S-4	SLO-1	*Analyze the past architectures*	*Messaging with SOAP protocol and SOAP nodes*	*Introduction to WSDL language basics*	*Java API for XML based RPC (JAX-RPC)*	*Notification and Eventing*
	SLO-2	*Scope Of SOA*	*SOAP message path*	*Define the structure of WSDL*	*Web Services Interoperability*	*Transaction Management*
S-5	SLO-1	*SOA Reference Model*	*Message exchange Patterns and Coordination*	*Implement sample WSDL file*	*SOA support in .NET*	*Case study-SOA in cloud*
	SLO-2	*Key Service characteristics of SOA*	*Web Services a Activity Management,*	*Introduction to SOAP basics*	*NET Platform overview*	*research focus on SOA and issues*
S-6	SLO-1	*Anatomy of SOA*	*Coordination types and protocols*	*SOAP language basics*	*ASP.NET Page Handling*	*Comparative Analysis of SOA and Cloud Computing*
	SLO-2	*SOA architecture*	*ACID properties*	*Structure of SOAP*	*Post back vs Non post back events*	
S-7	SLO-1	*Components in SOA interrelate*	*Analyze atomic transaction with SOA*	*Implement SOAP style web services in Java.*	*ASP.NET web services*	*Case Study On Vehicle management system-create a service for identify the vehicle by entering the vehicle number.*
	SLO-2	*SOA component and specific behaviors*	*Business activities and protocols*	*SOA Composition*	*Creating a Web Site Using Visual Studio IDE*	

S-8	SLO-1	*Relationships among these components*	*Orchestration*	*service layers and standards*	*ASP.NET Programming Basics*	*Case Study on Online Healthcare System- Design an API to help healthcare providers collect, store, retrieve and exchange patient healthcare information more efficiently and enable better patient care.*
	SLO-2	*Technical Benefits of SOA*	*Choreography*	*Entity-centric business service design: List the step-by-step process*	*Creating a Web Site Using Visual Studio IDE*	
S-9	SLO-1	*Business Benefits of SOA*	*Service layer configuration scenarios*	*Application service design: process steps*	*Case Studies: Implement the Small Business Customer Management application as a web applications using ASP.NET*	*Case study on Simple Library Management System using API to get, post, edits and update book data from server.*
	SLO-2	*Principles of service orientation*	*Application Service Layer*	*Task centric business service design process steps*	*Web Services Enhancements (WSE)*	

Learning Resources	1. *ThomasErl,-Service-Oriented Architecture: Concepts, Technology, and Design‖, Pearson Education, 2009.* 2. *EricNewcomer,Lomow,-UnderstandingSOAwithWebServices‖,PearsonEducation,2005* 3. *JamesMcGovern,SameerT yagi, Michael EStevens, Sunil Mathew, Java WebServices Architecture‖,Elsevier,2003.*	4. *AchievingService-Oriented Architecture: Applying an Enterprise Architecture Approach, Rick Sweeney, 2010* 5. *Shankar Kambhampaly, -Service –Oriented Architecture for Enterprise Applications‖, Wiley India Pvt Ltd, 2008 3.Newcomer, Lomow, -Understanding SOA with Web Services‖, Pearson Education, 2005 4.Sandeep Chatterjee, James Webber, -Developing Enterprise Web Services, An Architect's Guide‖, Pearson Education,2005.*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50%								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 %*	-	*15 %*	-	*30 %*	-	-	-	*20%*	-
Level 2	Understand	*20 %*	-	*25 %*	-	*40 %*	-	*40 %*	-	*20%*	-
Level 3	Apply	*60 %*	-	*60 %*	-	*30 %*	-	*60 %*	-	*60%*	-
Level 4	Analyse	-	-	-	-						
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.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts

Course Code	18CSE460T	Course Name	NETWORK DESIGN AND MANAGEMENT	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 Engineering	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Understand the various type of Networks and the Network Management basics			
CLR-2 :	Understand the Network Management Standards			
CLR-3 :	Understand the working of Simple Network Management Protocol and its various versions			
CLR-4 :	Understand the working of Remote Monitoring			
CLR-5 :	Understand the Network Management Applications			
CLR-6 :	To Understand Network Designing and Planning			

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 :	*Acquire knowledge on networks and network management*	*1*	*70*	*75*	*2*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	*Gain knowledge of the various standards*	*1*	*75*	*80*	*2*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	*Gain knowledge on the working of SNMP protocol and its various applications*	*1*	*85*	*80*	*3*	-	-	-	*3*	-	-	-	-	-	-	-	-	-	-
CLO-4 :	*To apply the network management tools and gather information from the network*	*2*	*75*	*70*	*2*	-	-	-	*3*	-	-	-	-	-	-	-	-	-	-
CLO-5 :	*To Familiarize with the working of various management applications*	*2*	*75*	*80*	*2*	-	-	-	-	-	-	-		-	-	-	-	-	-
CLO-6 :	*Apply the knowledge to create an efficient network*	*3*	*70*	*75*	*2*	-	-	-	*3*	-	-	-	-	-	-	-	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Telephone Network Management*	*Introduction to SNMP*	*Remote Monitoring*	*Network Management Applications*	*Network Design and Planning*
	SLO-2	*Distributed Computing Environment*	*SNMP v1 model*	*RMON SMI and MIB*	*Fault Management -Architecture*	*Network Design for Enterprise Network*
S-2	SLO-1	*TCP/IP Based Networks*	*Organization Model*	*RMON1*	*Fault location ,Fault isolation*	*Network Design Process*
	SLO-2	*Communication Protocols and Standards*	*System overview*	*RMON2*	*Algorithm*	*Data Collection*
S-3	SLO-1	*Protocol Layer and Services*	*SNMP v1 Information model*	*System Utilities for Management*	*Self-healing*	*Data Generation*
	SLO-2	*Challenges of IT Managers*	*Structure of Management Information*	*Tools*	*Avoiding failures*	*Traffic Generators*
S-4	SLO-1	*Network Management*	*Managed Objects*	*Network Statistics Measurement Systems*	*Configuration setting,*	*Cost Generators*
	SLO-2	*Network and System Management*	*MIB-Object Group*	*Traffic Load*	*Configuration discovery and Change Control*	*Topology*
S-5	SLO-1	*Network Management System Platform*	*System Group, Interfaces Group, Address Translation group*	*Protocol Statistics*	*Configuration Management Applications*	*Architecture*
	SLO-2	*Current status and future of Network Management*	*IP Group, ICMP Group, TCP Group, UDP Group*	*Data and Error Statistics*	*Patch Management*	*Graph*
S-6	SLO-1	*Network Management Standards*	*SNMP v1Communication model*	*Network Management System*	*Approaches for Performance Management*	*Link*
	SLO-2	*Network Management Model - Organizational model*	*Functional model*	*Components, Requirements*	*Performance Monitoring and Reporting*	*Algorithms*
S-7	SLO-1	*Information Model*	*SNMPv2*	*System Management*	*Performance trouble shooting,*	*Network Design Techniques*
	SLO-2	*Management Information Trees*	*System Architecture, MIB, Protocol*	*Network Management Applications*	*Capacity Planning*	*Performance Analysis*
S-8	SLO-1	*Communication Model*	*SNMPv3*	*Configuration Management*	*Account Management*	*Queuing Essentials*
	SLO-2	*ASN.1*	*Architecture, Applications, MIB*	*Inventory Management*	*Report Management-System and User Reports*	*Loss and Delay*
S-9	SLO-1	*Terminology, Symbols and Conventions*	*User Based Security Model*	*Performance Management*	*Policy Management*	*Reliability*
	SLO-2	*Functional Model*	*Access Control*	*Tools*	*Service Level Management*	*Network Cost*

Learning Resources	1. *Mani Subramanian "Network Management Principles and Practice", Second Edition, Pearson Publication, 2012.* 2. *DineshChandraVerma,"PrinciplesofComputerSystemsandNetworkManagement",Springer,2009.* 3. *Greg Tomsho, Ed Tittel, David Johnson, "Guide to Network Essentials", Fifth Edition, Cengage Learning, 2010 4.Teresa C.Piliouras ," Network Design Management and Technical Perspectives", Second Edition ,2004*

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 (5%)	Practice (5%)	Theory (7.5%)	Practice (7.5%)	Theory (7.5%)	Practice (7.5%)	Theory (5%)	Practice (5%)	Theory (25%)	Practice (25%)
Level 1	Remember	20%		15%		15%				15%	
Level 2	Understand	20%		25%		25%				20%	
Level 3	Apply	45%	30%	40%	35%	40%	40%	15%	20%	45%	30%
Level 4	Analyze	15%	40%	20%	35%	20%	30%	20%	50%	20%	35%
Level 5	Evaluate		30%		30%		30%	15%	30%		35%
Level 6	Create	20%		15%		15%				15%	
	Total	100 %	100 %	100 %	100 %	100 %	100 %			20%	

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. Mr.Vivekanandan ,Nokia Technology Specialist, anandanviv1@gmail.com	*1.*	*1. Dr.B.Amutha, SRMIST*
2.Mr.SanthoshKumar.S,Associate Consultant,TCS, santhosh.sansoft@gmail.com	*2.*	*2.Dr.N.Snehalatha, SRMIST*

Course Code	18CSO101T	Course Name	IT INFRASTRUCTURE MANAGEMENT	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	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning			Program Outcomes (PO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2	PSO-3
CLR-1 :	*Understand service delivery and associated processes*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Design, Conduct,	Modern Tool Usage	Society & Environment	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning				
CLR-2 :	*Understand service delivery and associated processes*																		
CLR-3 :	*Understand storage and security management related to IT Infrastructure*																		
CLR-4 :	*Understand performance and tuning processes and associated case studies*																		
CLR-5 :	*Understand the suitable for combinations in information technology, business administration and electronic*																		
Course Outcomes (CO):																			
CO-1 :	*Compare and describe the business value and processes of ICT services in an organization and apply that knowledge and skill with initiative to a workplace scenario*	*6*	*80*	*85*	*2*	-	-	*3*	-	-	-	-	*2*	-	-	-	*1*	*1*	-
CO-2 :	*Ability to investigate, critically analyze and evaluate the impact of new and current ICT services to an organization*	*4*	*75*	*80*	-	-	*2*	*3*	*1*	-	-	-	-	-	-	-	-	*2*	*3*
CO-3 :	*Be able to describe how effective IT Infrastructure Management requires strategic planning with alignment from both the IT and business perspectives in an organization*	*3*	*85*	*80*	-	-	*2*	*3*	*2*	-	-	-	-	-	-	-	*1*	-	*2*
CO-4 :	*Analyze the technical and communications skills that contribute to the operation of ICT services in an organization*	*6*	*80*	*75*	-	-	-	*3*	-	-	-	-	*2*	*2*	-	-	-	*3*	*2*
CO-5:	*Be able to reflect critically on the role of an enterprise architect in an organization*	*2*	*75*	*85*	-	-	*2*	*1*	-	*1*	-	-	-	-	-	-	*2*	-	*1*

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Introduction – IT Infrastructure*	*Service Delivery And Support Process - Intro*	*Storage And Security Management - Intro*	*Performance And Tuning Process*	*Case Studies*
	SLO-2	*Infrastructure Management Challenges in IT*		*Backup and Storage, Archive & Retrieve*		
S-2	SLO-1	*Design Factors for IT Organizations*	*Service Level Management*	*Space Management*	*Introduction on tuning process*	*Asset Network Corporation case*
	SLO-2	*Design Factors for IT Infrastructures*				
S-3	SLO-1	*Determining customer's Requirements, identifying system components to manage*	*Financial Management*	*Hierarchical space management*	*Difference between Performance and Tuning processes and other Infrasructure Processes*	*Radio Shack case*
	SLO-2					
S-4	SLO-1	*Identifying System Components to manage*	*IT Service Continuity Management*	*Database & Application protection*	*Definitions*	*Business Process Outsourcing (BPO) Infrastructure Planning and Management*
	SLO-2					
S-5	SLO-1	*Exist Processes, Data, applications*	*Capacity Management*	*Disaster Recovery Bare Machine Recovery (BMR)*	*Preferred characteristics*	*e-Commerce Business Infrastructure Planning and Management*
	SLO-2					
S-6	SLO-1	*Tools and their integration*	*Configuration Management*	*Data Retention*	*Performance and tuning applied to major resource environments*	*Enron case*
	SLO-2					

S-7	SLO-1 SLO-2	*IT Systems and Service management process*	*Service desk, Incident management*	*Computer Security Identity Management*	*Assessing an Infrastructure's performance and tuning process*	*Tycocase*
S-8	SLO-1 SLO-2	Information systems Design Process	Availability management,	Access control system	Measuring and streamlining the P and T process	Worldcom case
S-9	SLO-1 SLO-2	IT Infrastructure Library	Release Management	Intrusion Detection	Performance tuning recommendations for data and event management	Analyze an information infrastructure – case study

Learning Resources	1. *Rich Schiesser, " IT Systems Management", 2nd edition, 2010, Pearson Education, ISBN: 978-0137025060* 2. *P.Gupta,"IT Infrastructure and Its Management" 2ndReprint,2010,TataMcGrawHill,ISBN: 978-0070699793* 3. *SjaakLaan," ,"ITInfrastructureArchitecture:InfrastructureBuildingBlocksandConcepts", 2011, Lulu Press Inc, ISBN978-1-4478-8128-5* 4. *Leonard Jessup,Joseph Valacich,"Information System Today: ManagingDigitalWorld", 3rdEdition, 2007, Prentice Hall, ISBN:0-13-233506-9* 5. *Hausman,Cook,:IT Architecture for Dummies",2011,Wiley Publishing,Hoboken,NJ www.wiley.com ISBN:978-0-470-55423-4* 6. *Richardj,Reese, "IT Architecture in Action",2008,Xlibris Publishing, ISBN:978-1-4363-0505-1*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment								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	*35%*	-	*40%*	-	*35%*	-	*30%*	-	*35%*	-
Level 4	Analyze	25%	-	20%	-	25%	-	30%	-	25%	-
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.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.Mohamed Yaseen MS,Technical Business Analyst,CBA-Sydney,Australia,yasucseau@gmail.com	*1. Dr.J.Baskar Babujee,Associate Professor,Madras Institute of Technology,channai,baskarjee@annauniv.edu*	*1.Dr.C.N.S.Vinoth kumar ,SRMIST*
2.Mr.P.AnandaNatarajan,Senior Associate Consultant, Infosys, Chennai., anand_adnan@yahoo.com	*2. Dr.K.SELVA BHUVANESWARI, Assistant Professor, University College of Engineering Kanchipuram*	*2. Dr.M.B.Mukesh Krishnan,SRMIST*

Course Code	18CSO102T	Course Name	MOBILE APPLICATION DEVELOPMENT	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	Computer Science &Engg	Data Book / Codes/Standards	Nil		

Course Objectives:	The purpose of learning this course is to:
1 :	Understand the basics of Android devices andPlatform.
2 :	Acquire knowledge on basic building blocks ofAndroid programming required for Appdevelopment.
3 :	Understand persistence Data storage mechanismin Android
4 :	Understand advanced application concepts likenetworking, Animations and Google Maps services etc.
5 :	Develop and publish Android applications in toAndroid Market

Course Outcomes (CO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)												PSO		
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
		Level ofThinking (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	LifeLong Learning	PSO-1	PSO-2	PSO-3
CO-1 :	Acquire the knowledge on Android devices and Platform	4	60	70	1	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO-2 :	Acquire knowledge on basic building blocks of Android programming required for App development.	4	60	70	1	-	3	-	-	-	-	-	-	-	-	-	1	1	-
CO-3 :	Apply the knowledge of persistence Data storage mechanism-in Android	4	60	70	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO-4 :	Apply the knowledge in advanced application concepts like networking, Animations and Google Maps services etc.	4	60	70	1	-	3	-	3	-	-	-	-	-	-	-	-	-	-
CO-5 :	Design and apply the knowledge to publish Android applications in to Android Market	4	60	70	3	-	-	3	-	-	-	-	-	-	-	-	3	3	1

Duration (hour)		9	9	7	10	10
S-1	SLO-1	Introduction: Introduction to mobile application development, trends.	GUI for Android: Introduction to activities life-cycle	Introduction to Different Data persistence schemes	Services :introduction to services–localservice,	Introduction to Location based services
	SLO-2					
S-2	SLO-1	introduction to various platforms,	Android v7 supportlibrary form API21 for lower versionsupport	Shared preferences	remote service and binding theservice,.	Google maps V2 services using Google API.
	SLO-2					
S-3	SLO-1	introduction to smart phones	Intent :intent object	File Handling se	the communication between serviceand activity, Intent Service	Animations and Graphics: PropertyAnimation .
	SLO-2					
S-4	SLO-1	Android platform: Android platform,features and architecture,	intent filters ,addingcategories	Managing data using SQLite databa	MultiThreading: Handlers	View Animations, DrawableAnimations
	SLO-2					
S-5	SLO-1	versions ,comparison added features in each versions.	linking activities, user interfacedesign components	Content providers:	,AsyncTask	Media and Camera API: Working withvideo and audio inputs
	SLO-2					
S-6	SLO-1	ART(Android Runtime),ADB(AndroidDebug Bridge).	Views and View Groups: Basic views,picker views, adapter views, Menu, App Baretc, basics of screen design; differentlayouts.	user content provider	android network programming:HttpUrlConnection	Camera API
	SLO-2					
S-7	SLO-1	Development environment/IDE: Android studio and its working environment	App widgets.Lollipop Materialdesign: new themes, new widgets,Cardlayouts. RecyclerView	Android in build content providers	Connecting to REST-based and SOAP based Web services	Sensor programming: Motion sensors
	SLO-2					
S-8	SLO-1	gradle build system, emulator setup	Fragments: Introduction to activities,		Broad castreceivers:LocalBroadcastManager,Dynamic broadcast receiver	Position sensors, Environmental sensors.
	SLO-2					

S-9	SLO-1 SLO-2	*Application anatomy: Applicationframework basics: resources layout, values,asset XML representation and generatedR.Javafile ,Android manifest file. Creating asimple application.*	*activities life-cycle.*		*System Broadcast. PendingIntent, Notifications*	*Publishing Android Apps: Guide lines.*
S-10					*Telephony Manager:Sending SMS andmaking calls.*	*policies and process of uploading Apps toGoogle play*

Learning Resources	1. *Dawn Griffiths, David Griffiths,"Head First: Android Development" ,OReilly2015,ISBN:9781449362188.* 2. *Greg Milette,Adam Stroud,"PROFESSIONALAndroid™ Sensor Programming", John Wiley and Sons, Inc2012,ISBN/978111265055,9781280678943,978111227459*	3. *PaulDeital,HarveyDeital,AlexanderWald,"Android6forProgrammers,AppDrivenapproach",2015, Prentice Hall ,ISBN:9780134289366.* 4. *http://developer.android.com/training/index.htmlas on Date21.4.2016*

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%	-	15%	-	15%	-	15%	-	15%	-
Level 2	Understand	20%	-	15%	-	15%	-	15%	-	20%	-
Level 3	Apply	45%	-	40%	-	40%	-	20%	-	30%	-
Level 4	Analyze	15%	-	15%	-	15%	-	25%	-	20%	-
Level 5	Evaluate	-	-	15%	-	15%	-	25%	-	15%	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %	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.KHANNA NEHEMIAH , Professor,Ramanujan Computing, Anna University***	***1. Dr.M.UMA***
		2. Dr.Ganesh Kumar, SRMIST
		3.Mr.K.Naveen

Course Code	18CSO103T	Course Name	SYSTEM MODELING AND SIMULATION	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	Computer Science and Engineering	Data Book / Codes/Standards		Nil	

Course Objectives):	The purpose of learning this course is to:	Learning		
		1-6		
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
1	Acquire the ability to select a suitable modeling method according to problem area and assignment, and justify their choice.			
2	Apply the continuous system simulation on problems			
3	Acquire the fundamentals of probability concepts in simulation problems			
4	Incorporate Queueing theory concepts and implement discrete event simulation models			
5	Apply the simulation languages and tools on problems			

Course Outcomes (CO):	At the end of this course, learners will be able to:	Learning			Program Outcomes (PO)												Program Specific Outcome (PSO)		
					1	2	3	4	5	6	7	8	9	10	11	12			
		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
CO-1 :	Choose and justify the appropriate modeling method for the given problem	4	60	70	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO-2 :	Apply the models under continuous system simulation	4	60	70	1	-	1	-	2	-	-	-	-	-	-	-	-	-	-
CO-3 :	Incorporate the probability concepts for simulating a system	4	60	70	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-4 :	Apply Queueing theory concepts on discrete event simulation models	4	60	70	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-
CO-5 :	Apply tools to like GPSS and SIMSCRIPT to check model properties of a system	4	60	70		-	1	-	1	-	-	-	-	-	-	-	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Introduction to system modelling	Continuous System Simulation - Introduction	Probability Theory	Queueing Theory - Introduction	General description of GPSS and SIMSCRIPT
S-2	SLO-1	Modeling principles and concepts	Numerical solution of differential equations	Probability CONCEPTS IN SIMULATION -	Arrival Pattern distributions	programming in GPSS
S-3	SLO-1	Continuous systems and Discrete systems	Analog computers	Monte Carlo techniques	servicing times, queuing disciplines	Application of GPSS on specific problem
S-4	SLO-1	Modeling, types of models,subsystems	Hybrid computers	Application of Monte Carlo techniques	measure of queues	Simulation Programming Techniques
S-5	SLO-1	corporate model, system study..	continuous system simulation languages CSMP	Stochastic variables	mathematical solutions to queuing problems	Data Structures
S-6	SLO-1	System Simulation: Techniques,	system dynamic growth models,	probability functions	Discrete system simulation: Events	Implementation of activities
S-7	SLO-1	comparison of simulation and analytical methods	logistic curves	Random Number Generation algorithms	Generation of arrival pattern	Events and queues, event scanning
S-8	SLO-1	types of simulation, distributed log models	Illustration of Continuous System Simulation	Illustration of Probability concepts	Simulation programming tasks	Simulation algorithms in GPSS and SIMSCRIPT
S-9	SLO-1	cobweb models	Case Study	Case Study	Analysis of simulation output	Case Study

Learning Resources	
	1. *Geoffery Gordon, " System Simulation" , PHI, 2nd edition*
	2. *Jerry Banks , John S.Carson ,Barry Nelson, David M.Nicol, "Discrete – Event System Simulation", PHI, 3rd edition*
	3. *Karian. Z.A., Dvdewicz .E.Z, "Modern Statistical Systems and GPSS Simulation",Freeman, 1991*

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 (5%)	Practice	Theory (25%)	Practice
Level 1	Remember	20%	-	15%	-	10%	-	-	-	15%	-
Level 2	Understand	20%	-	25%	-	20%	-	20%	-	25%	-
Level 3	Apply	40%	-	40%	-	30%	-	40%	-	40%	-
Level 4	Analyze	20%	-	20%	-	40%	-	40%	-	20%	-
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.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		1. Prof.S.S.Sridhar, SRMIST
		2. Mr. C.Arun, SRMIST

Course Code	18CSO104T	Course Name	FREE AND OPEN SOURCE SOFTWARES	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	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Objectives	*The purpose of learning this course is to:*	Learning
1	*Be exposed to the context and operation of free and open-source software (FOSS) communities.*	1-6
2	*Be familiar with participating in a FOSS project*	
3	*Learn shell scripting*	
4	*Explore the FOSS tools and techniques*	
5	*Can develop a open source software*	

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Level of Thinking (Bloom)	Expected roficiency (%)	Expected Attainment (%)
CO-1 :	*Exhibit knowledge on basics of FOSS*	*4*	*60*	*70*
CO-2 :	*Demonstrate ability to configure and install Linux*	*4*	*60*	*70*
CO-3 :	*Write program using shell scripting*	*4*	*60*	*70*
CO-4 :	*Build and modify one or more Free and Open-Source Software packages*	*4*	*60*	*70*
CO-5 :	*Apply the knowledge to develop a Free and Open-Source Software development projects.*	*4*	*60*	*70*

Program Outcomes (PO)												PSO		
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	PSO - 1	PSO - 2	PSO – 3
1	-	-	*3*	-	-	-	-	-	-	-	-	-	-	-
1	-	*2*	-	-	-	-	-	-	-	-	-	-	-	-
1	-	*2*	-	-	-	-	-	-	-	-	-	-	-	-
-	-	*2*	-	*3*	-	-	-	-	-	-	-	-	-	-
-	-	-	-	*1*	-	-	*3*	*2*	-	-	-	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Introduction- Open Source, Free Software, Free Software vs. Open Source software*	*Linux Installation and Hardware Configuration*	*Unix file system, Unix files, i-nodes and structure and file system related commands*	*Usage of design Tools like Argo UML or equivalent*	*Open Source Software Development*
	SLO-2					
S-2	SLO-1	*FOSS examples*	*Boot Process-The Linux Loader (LILO)*	*Shell Programming, Shell as command processor, Shell variables*	*Version Control Systems like Git or equivalent*	*Case Study – Libreoffice -Samba*
	SLO-2	*FOSS Characteristics*	*The Grand Unified Boot loader (GRUB)*			
S-3	SLO-1	*FOSS History, Examples*	*Dual-Booting Linux and other Operating System*	*Creating command substitution, Scripts*	*Bug Tracking Systems*	
	SLO-2	*FOSS Copyright*	*Boot-Time Kernel Options*			
S-4	SLO-1	*Guidelines for effectively working with FOSS community*	*Basic Linux Commands*	*Creating commands for Functions, Conditionals*	*Package Management Systems*	
	SLO-2					
S-5	SLO-1	*Benefits of Community based Software Development*	*Linux Commands for operations - redirection, pipes, filters, job control, changing ownership/permission of files/directories*	*Creating commands for loops*	*Introduction to Programming language using Python*	
	SLO-2					
S-6	SLO-1	*Requirements for being open, free software, open source software*	*Advanced Linux Commands like curl, wget, ftp, ssh and grep*	*Customizing environment*	*Basic commands, variables, Decision Making, Lists, Modules, strings, looping,*	*Case Studies : Apache, BSD, Linux, Mozilla (Firefox), Wikipedia, Joomla, GCC,*
	SLO-2					

S-7	SLO-1	*Four degrees of freedom*	*X Windows System Configuration*	*Shell scripting for system configurations*	*conditional statements, classes, Exceptions packages*	*Open Office*
	SLO-1					
S-8	SLO-1	*FOSS Licensing Models*	*System Administration*	*Shell scripting with functions and conditions*		
	SLO-2	*FOSS Licenses – GPL- AGPL- LGPL – FDL*	*Backup and Restore Procedures*			
S-9	SLO-1	*Implications*	*Strategies for keeping a Secure Server*	*Shell scripting with looping*		
	SLO-2					

Learning Resources	1. *EllenSiever,StephenFiggins,RobertLove,ArnoldRobbins,"LinuxinaNutshell",Sixth Edition, OReilly Media, 2009.* 2. *LinuxProgrammingBiblebyJohnGoerzen,IDGBooks,NewDelhi,2000.* 3. *Your Unix - The Ultimate Guide by Sumitabha Das, TMH,2000*	4. *PerlProgrammingbookathttp://www.perl.org/books/beginning-perl/.* 5. *Rubyprogrammingbookathttp://ruby-doc.com/docs/ProgrammingRuby/.* 6. *Samba: URL :http://www.samba.org/.*

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 (5%)	Practice (5%)	Theory (7.5%)	Practice (7.5%)	Theory (7.5%)	Practice (7.5%)	Theory (5%)	Practice (5%)	Theory (25%)	Practice (25%)
Level 1	Remember	20%		15%		15%		15%		15%	
Level 2	Understand	20%		25%		25%		25%		25%	
Level 3	Apply	45%		40%		40%		40%		40%	
Level 4	Analyze	15%		20%		20%		20%		20%	
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.

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.BijoymonSoma n Sr. Test Analyst UST Global, Philadelphia,PA, USA	*1. Dr.Arun kumar M N Assistant Professor, Federal Institute of Science and Technology, Angamaly, Kerala*	*1. Mrs Aswathy K Cherian, SRMIST*
		2.Mrs. Nimala , SRMIST

Course Code	18CSO105T	Course Name	ANDROID DEVELOPMENT	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	*Computer Science and Engineering*	**Data Book / Codes/Standards**	*Nil*		

Course Objectives:	*The purpose of learning this course is to:*
1 :	*Understand the basics of Android devices and Platform.*
2 :	*Acquire knowledge on basic building blocks of Android programming required for Application development*
3 :	*Gain knowledge to user interfaces used in android applications*
4 :	*Acquire knowledge on advanced application concepts like networking, Animations and Google Maps services etc.*
5 :	*Develop and publish Android applications in to Android Market with the knowledge of JSON and MQTT*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	**Learning**			**Program Outcomes (PO)**												**PSO**		
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12			
		Level of Thinking	Expected Proficiency	Expected Attainment	Engineering	Problem Analysis	Design &	Analysis, Design,	Modern Tool Usage	Society & Culture	Environment &	Ethics	Individual & Team	Communication	Project Mgt. &	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CO-1 :	*Exhibit knowledge on fundamentals of technologies associated with Android Platform*	*4*	*60*	*70*	*3*	-	-		-	-	-	-	-	-	-	-	-	-	-
CO-2 :	*Demonstrate competency in the fundamentals of building blocks of Android application development*	*4*	*60*	*70*	-	-		*2*	-	-	-	-	-	-	-	-	-	-	-
CO-3 :	*Utilize existing API and interface services of other platforms*	*4*	*60*	*70*	*3*	-	-	*2*	-	-	-	-	-	-	-	-	-	-	-
CO-4 :	*Designing and developing mobile applications using a development framework*	*4*	*60*	*70*	-	-	*3*	-	-	-	-	-	*2* -	-	-	-	-	-	-
CO-5 :	*Develop an android application to acquire and process data*	*4*	*60*	*70*	-	-	*3*	-	-	-	-	-	*2* -	-	-	-	-	-	-

Duration (hour)		**9**	**9**	**9**	**9**	**9**
S-1	SLO-1	*Creating a new Android Project*	Hosting a UI Fragment	Action Bar and Options Menus	Loopers, Handlers, and HandlerThread	Introduction to JSON
	SLO-2	*Defining the Project and SDK setting*	Creating a UI Fragment	Enabling Ancestral Navigation	Creating a search interface	JSON and Android
S-2	SLO-1	*Creating an Android Virtual Device (AVD) in Android Studio*	Adding a UI Fragment to the FragmentManager	An Alternative Menu Item	Hardware search button	Designing JSON and JSON Operation
	SLO-2	*Android Virtual Device (AVD) in Android Studio*	The FragmentManager and the fragment lifecycle	Saving and Loading Local Files	Creating an IntentService	Server reachability and Connection & Splash App
S-3	SLO-1	*Configuring the Android Studio AVD Emulator*	Creating User Interfaces with Layouts and Widgets	Context Menu Resource	Delayed Execution with AlarmManager	Lazy Loading Images
	SLO-2	*The Emulator Environment and Toolbar Options*	XML Layout Attributes	Floating Context Menu	Broadcast Intents	Lazy loading Libraries
S-4	SLO-1	*Extended Control options*	the Graphical Layout Tool	Contextual Action Mode	Waking Up on Boot	Lazy loading Archirtecture
	SLO-2	*Drag and Drop Support*	Creating a ListFragment	Camera I: Viewfinder	Filtering Foreground Notifications	Handling Image Assets
S-5	SLO-1	*Configuring Fingerprint Emulation*	Hosting a Fragment	Using the Camera API	Receivers and Long-running Tasks	Remote Crash Logs and App
	SLO-2	*Android Studio Apps on a Physical Android Device*	ListFragment, ListView and ArrayAdapter	Camera II: Taking Pictures and Handling Images	Browsing The Web & WebView	Push Messaging Services
S-6	SLO-1	*Enabling ADB on Android based Devices*	Fragment Arguments	Updating the Model Layer	Custom Views and Touch Events	Firebase Cloud Messaging
	SLO-2	*Android Studio Editor*	ViewPager	Updating CrimeFragment's View	Creating BoxDrawingView	Open-Source Push Messaging with MQTT

S-7	SLO-1	*Splitting the Editor Window, Code Completion, Statement Completion*	Dialogs	Implicit Intents	Handling Touch Events	MQTT App and Project
	SLO-2	*Parameter Information, Parameter Name Hints,*	Audio Playback Using MediaPlayer	Two-Pane Master-Detail Interfaces	Tracking the Device's Location	Message Brokers
S-8	SLO-1	*Code Generation*	Retained Fragments	Adding Layout Flexibility	Locations and the LocationManager	MQTT Broker setup for AWS
	SLO-2	*Code Folding*	Rotation and Retained Fragments	Activity: Fragment Boss	Receiving Broadcast Location Updates	Sending Messages with MQTT Web Clients
S-9	SLO-1	*Quick Documentation Lookup*	Rotation Handling and onSaveInstanceState(Bundle)	Styles And includes	Updating the UI with Location Data	Firebase Cloud Messaging
	SLO-2	*Code Reformatting*	Localization	Cleaning Up with Styles	Testing Locations on Real and Virtual Devices	MQTT Push Messaging

Learning Resources	1. *Neil Smyth, Kotlin / Android Studio 3.0 Development Essentials - Android 8 Edition, Payload Media, Inc.2017* 2. *Bill Phillips and Brian Hardy, Android Programming: The Big Nerd Ranch Guide, Big Nerd Ranch, Inc. 2013*	3. *Mark Wickham, Practical Android: 14 Complete Projects on Advanced Techniques and Approaches, Apress, 2018* 4. *David Griffiths, Head First: Android Development, OReilly2015, ISBN: 9781449362188*

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 (10%)	Practice	Theory (15%)	Practice	Theory (15%)	Practice	Theory (10%)	Practice	Theory (50%)	Practice
Level 1	Remember	20%		15%		15%		15%		15%	
Level 2	Understand	20%		25%		25%		25%		25%	
Level 3	Apply	45%		40%		40%		40%		40%	
Level 4	Analyze	15%		20%		20%		20%		20%	
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.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. *Dinesh Babu T, Development Manager, HP India. dinesh.thavamani@hp.com*		1. *Dr.S.Pradeep, SRMIST*
2. *Suraj Sundaram, Associate IT Consultant, TCS Canada. surajs2@tcs.com*		2. *Mr. C. Arun, SRMIST*

Course Code	18CSO106T	Course Name	DATA ANALYSIS USING OPEN SOURCE TOOL	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	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Objectives:

1 :	Define basic R commands
2 :	Evaluate Linear regression to manipulate statistical data in R
3 :	Analyse working of classifiers and clustering in R
4 :	Construct Linear Model selection and regularization in R
5 :	Incorporate Tree based methods in R

Course Outcomes (CO): 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
CO-1 :	Write basic commands in R	3	70	75	3	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO-2 :	Express the ability to workout linear regression in R	3	70	75	3		-	-	-	-	-	-	-	-	-	-	-	-	-
CO-3 :	Develop the ability to work with classification and clustering in R	3	65	70	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-4 :	Incorporate Linear Model selection and regularization in R	4	65	70	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO-5 :	Construct Tree based methods in R	4	65	70	3	3	-	3	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Data in data analytics	Simple Linear Regression	An Overview of Classification	Cross-Validation The Validation Set Approach	The Basics of Decision Trees- Regression Trees
	SLO-2	NOIR classification	Estimating the coefficients	Logistic Regression - The Logistic Model	Leave-One-Out Cross-Validation	Classification Trees
S-2	SLO-1	Introduction to R	Assessing the Accuracy of the CoefficientEstimates	Estimating the Regression Coefficients	k-Fold Cross-Validation	Trees Versus Linear Models
	SLO-2	Data types	Assessing the Accuracy of the Model	Making Predictions	Bias-Variance Trade-Off for k-Fold Cross-Validation	Advantages and Disadvantages of Trees
S-3	SLO-1	Control structures	Libraries for Simple Linear Regression in R	Multiple Logistic Regression	The Validation Set Approach in R	Bagging -Random Forests
	SLO-2	Control structures - Using the console	Programming in simple linear regression in R	Logistic Regression for >2 Response Classes	Leave-One-Out Cross-Validation in R	Boosting
S-4	SLO-1	Objects in R - Numbers, Attributes	Multiple Linear Regression - Estimatingthe Regression Coefficients	Linear Discriminant Analysis - Using Bayes' Theorem for Classification	k-Fold Cross-Validation .in R	Fitting Classification Trees in R
	SLO-2	Vectors - create vectors	Multiple Linear Regression in R	Linear Discriminant Analysis forp = 1	The Bootstrap in R	Fitting Regression Trees in R
S-5	SLO-1	Using [] brackets	Extensions of the Linear Model	Linear Discriminant Analysis for p>1	Linear Model Selection and Regularization- Subset Selection	Bagging and Random Forests in R
	SLO-2	Vectorized operations	Potential Problems	Quadratic Discriminant Analysis	Stepwise Selection Choosing the Optimal Model	Boosting in R
S-6	SLO-1	Matrix -building a matrix, Naming dimensions, Colnames and Rownames	The Marketing Plan	Logistic Regression, LDA,	Shrinkage MethodsRidge Regression	Principal Components Analysis - What ArePrincipal Components?
	SLO-2	Matrix operations, Visualizing withMatplot()	Comparison of Linear Regression with K-Nearest Neighbors	QDA, and KNN in R - T	The Lasso Selecting the Tuning Parameter	More on PCA
S-7	SLO-1	Data frame	Qualitative Predictors	Example using Stock Market Data	Dimension Reduction Methods Principal Components RegressionP	Principal Components Analysis in R
	SLO-2	List	Extensions of the Linear Model	Logistic Regression in R	artial Least Squares	More on PCA - Other Uses for Principal Components
S-8	SLO-1	Functions	Interaction Terms in R	Linear Discriminant Analysis in R	Best Subset Selection in R	Clustering Methods- K-Means Clustering
	SLO-2	Indexing data	Non-linear Transformations of the Predictors in R	Quadratic Discriminant Analysis in R	Forward and Backward Stepwise Selection in R	Hierarchical Clustering
S-9	SLO-1	Reading data	Qualitative Predictors in R	K-Nearest Neighbors in R	Choosing Among Models Using the Validation Set Approach and Cross-Validation in R	K-Means Clustering in R
	SLO-2	Writing data	Writing Functions for linear regression in R	An Application to Caravan Insurance Data in R	Ridge Regression and the Lasso in R	Hierarchical Clustering in R

Learning Resources	*1. G James, D. Witten, T Hastie, and R. Tibshirani, An Introduction to Statistical Learning: with Applications in R, Springer, 2013* *2. Chambers, John, Software for Data Analysis Programming with R, Springer, 2008* *3. Trevor Hastie Robert Tibshirani Jerome Friedman,The Elements of Statistical Learning, Data Mining, Inference, and Prediction (2nd Edn.), Springer, 2014* *4. Mark Gardener,Beginning R: The Statistical Programming Language, Wiley, 2013* *5. Upadhyaya and A. Upadhyaya, Material Science and Engineering, Anshan Publications, 2007*	

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		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	*20 %*		*20 %*		*20 %*		*20 %*		*20 %*	
Level 5	Evaluate	*10%*	-	*10%*	-	*10%*	-	*10%*	-	*10%*	-
Level 6	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

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Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.Venkatesh K. Pappakrishnan, Ph.D. *Data scientist | Physicist, Santa Clara, California*	*1. Dr. J. Prakash, MIT, Chennai, prakaiit@rediffmail.com*	*1. Dr.V.Kavitha, SRMIST* *2. Dr.Alice Nithya, SRMIST*
2. Prakash V, *Technical Lead at Bridgeline Digital IncGreater Boston Area*	*2. Dr.Latha Karthigaa, PhD, Innovation Research Assistant, The University of Auckland*	*3. Dr. Sindhu C, SRMIST*