SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

FACULTY OF ENGINEERING AND TECHNOLOGY

PROGRAMME: B.TECH (CSE) – PART TIME - CURRICULUM AND SYLLABUS 2019

SCHOOL OF COMPUTING
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
SRM INSTITUTE OF SCIENCE AND TECHNOLOGY
FACULTY OF ENGINEERING AND TECHNOLOGY

SCHOOL OF COMPUTING
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CURRICULUM & SYLLABUS

SEMESTER I

Subject Code	Category	Subject Name	L	T	P	C
Theory						
19PMAB01T	B	Transformsand Boundary Value Problems	3	1	0	4
19PCSC11J	C	Programming for Problem Solving	3	0	2	4
19PCSC12T	C	Computer Organization and Architecture	3	0	0	3
19PCSC13J	C	Data Structures and Algorithms	3	0	2	4
Total			**12**	**1**	**4**	**15**

SEMESTER II

Subject Code	Category	Subject Name	L	T	P	C
Theory						
19PMAB03T	B	Discrete Mathematics for Engineers	3	1	0	4
19PCSC14J	C	Object Oriented Design and Programming	3	0	2	4
19PCSC15J	C	Design and Analysis of Algorithms	3	0	2	4
19PCSC16T	C	Software Engineering and Project Management	3	0	0	3
Total			**12**	**1**	**4**	**15**

SEMESTER III

Subject Code	Category	Subject Name	L	T	P	C
Theory						
19PCSC21J	C	Operating Systems	3	0	2	4
19PCSC22J	C	Advanced Programming Practice	3	0	2	4
19PCSC23T	C	Formal Language and Automata	3	1	0	4
19PCSC26T	C	Computer Communications	3	0	0	3
Total			**12**	**1**	**4**	**15**

SEMESTER IV

Subject Code	Category	Subject Name	L	T	P	C
Theory						
19PCSC24J	C	Computer Networks	3	0	2	4
19PCSC25J	C	Artificial Intelligence	3	0	2	4
	E	Professional Elective – I	3	0	0	3
	E	Professional Elective – II	3	0	0	3
Total			**12**	**0**	**2**	**14**

SEMESTER V

Subject Code	Category	Subject Name	L	T	P	C
Theory						
19PCSC31J	C	Compiler Design	3	0	2	4
19PCSC32J	C	Database Management Systems	3	0	2	4
	O	Open Elective – I	3	0	0	3
	E	Professional Elective – III	3	0	0	3
Total			**12**	**0**	**4**	**14**

SEMESTER VI

Subject Code	Category	Subject Name	L	T	P	C
Theory						
	O	Open Elective – II	3	0	0	3
	E	Professional Elective – IV	3	0	0	3
	E	Professional Elective – V	3	0	0	3
19PCSC33T	C	Machine Learning	3	0	0	3
Total			**12**	**0**	**0**	**12**

SEMESTER VII

Subject Code	Category	Subject Name	L	T	P	C
Theory						
	E	Professional Elective – VI	3	0	0	3
19PCSC41T	C	Network Security	3	0	0	3
Practical						
19PCSP42L	P	Major Project	0	0	30	15
Total			**6**	**0**	**30**	**21**

TOTAL CREDITS TO BE EARNED: 106

Summary Table

Semester	I	II	III	IV	V	VI	VII	Total	%
Total	**15**	**15**	**15**	**14**	**14**	**12**	**21**	**106**	**100**
B	**4**	**4**	**0**	**0**	**0**	**0**	**0**	**8**	**7.5**
C	**11**	**11**	**15**	**8**	**8**	**3**	**3**	**59**	**55.7**
E	**0**	**0**	**0**	**6**	**3**	**6**	**3**	**18**	**17.0**
O	**0**	**0**	**0**	**0**	**3**	**3**	**0**	**6**	**5.7**
P	**0**	**0**	**0**	**0**	**0**	**0**	**15**	**15**	**14.1**

Electives for Fourth and Fifth Semesters

Subject Code	Subject Name	L	T	P	C
19PCSE21T	Digital Image Processing	3	0	0	3
19PCSE22T	Distributed Operating Systems	3	0	0	3
19PCSE23T	Information Storage and Management	3	0	0	3
19PCSE24T	Computational Logic	3	0	0	3
19PCSE25T	Biometrics	3	0	0	3
19PCSE31T	Wireless and Mobile Communication	3	0	0	3
19PCSE32T	Service Oriented Architecture	3	0	0	3
19PCSE33T	Network Design and Management	3	0	0	3
19PCSE34T	Natural Language Processing	3	0	0	3
19PCSE35T	Applied Machine Learning	3	0	0	3

Electives for Sixth and Seventh Semester

Subject Code	Subject Name	L	T	P	C
19PCSE36T	Pattern Recognition Techniques	3	0	0	3
19PCSE38T	Neuro Fuzzy and Genetic Programming	3	0	0	3
19PCSE39T	Network Routing Algorithms	3	0	0	3
19PCSE40T	Network Protocols and Programming	3	0	0	3
19PCSE41T	Wireless Sensor Networks	3	0	0	3
19PCSE42T	High Performance Computing	3	0	0	3
19PCSE43T	Database Security and Privacy	3	0	0	3
19PCSE44T	Data Mining and Analytics	3	0	0	3
19PCSE45T	Principles of Cloud computing	3	0	0	3

Open Electives

Subject Code	Subject Name	L	T	P	C
19PCSO11T	IT Infrastructure Management	3	0	0	3
19PCSO12T	Mobile Application Development	3	0	0	3
19PCSO13T	System Modeling and Simulation	3	0	0	3
19PCSO14T	Free and Open Source Softwares	3	0	0	3
19PCSO15T	Android Development	3	0	0	3
19PCSO16T	Data Analysis using Open Source Tool	3	0	0	3
19PCSO17T	IOS Development	3	0	0	3

Course Code	19PMAB01T	Course Name	TRANSFORMS AND BOUNDARY VALUE PROBLEMS	Course Category	B	Basic Sciences	L	T	P	C
							3	1	0	4

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

Course Learning Rationale (CLR):	The purpose of learning this course is as follows:
CLR-1 :	Describe different types of Partial differential equations interpret the solutions relate PDE to the respective branches of engineering
CLR-2 :	Relate Fourier series expansion in solving problems under RMS value and Harmonic Analysis.
CLR-3 :	To infer the most general form to the PDE and relate to half range sine and cosine series, as the case may be
CLR-4 :	Evaluate the various types of integral transforms
CLR-5 :	Conclude that the purpose of studying z transform is to solve linear difference equations having constant coefficients
CLR-6	Predicting the importance of PDE, Fourier series, Boundary value problems and Fourier ,Z – transform applications

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		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 :	Determine Partial differential equation	3	85	80	M	H	L						M			H			
CLO-2 :	Explain the expansion of a discontinuous function as an infinite form of trigonometric sine and cosine series.	3	85	80	M	H		M	M				M	L		H			
CLO-3 :	Decide a proper form of solution for the differential equations which are of hyperbolic and parabolic type	3	85	80	M	H							M			H			
CLO-4 :	To justify the relationship between aperiodic signals and linear combination of exponentials.	3	85	80	M	H		M					M	L		H			
CLO-5 :	Relate signal analysis with that of z transform	3	85	80	M	H	L						M			H			
CLO-6 :	Relate PDE, Fourier series, Boundary value problems, Fourier and Z transforms	3	85	80	M	H							M			H			

		Learning Unit / Module 1	Learning Unit / Module 2	Learning Unit / Module 3	Learning Unit / Module 4	Learning Unit / Module 5
Duration (hour)		12	12	12	12	12
S-1	SLO-1	Formation of partial differential equation by eliminating arbitrary constants	Introduction of Fourier series - Dirichlet's conditions for existence of Fourier Series	Classification of second order partial differential equations	Introduction of Fourier Transforms	Introduction of Z-transform
	SLO-2	Formation of partial differential equation by eliminating two or more arbitrary constants	Fourier series –related problems in $(0,2\pi)$	Method of separation of variables	Fourier Transforms- problems	Z-transform-elementary properties
S-2	SLO-1	Formation of partial differential equation by eliminating arbitrary functions	Fourier series –related problems in $(-\pi,\pi)$	One dimensional Wave Equation and its possible solutions	Properties of Fourier transforms	Z-transform- change of scale property, shifting property
	SLO-2	Formation of partial differential equation by eliminating two or more arbitrary functions	Change of interval Fourier series –related problems in $(0,2l)$	One dimensional Wave Equation-initial displacement with zero initial velocity-type 1 Algebraic function	Standard results of Fourier transforms	Z-transform of $a^n, \frac{1}{n}, \frac{1}{n+1}$

S-3	**SLO-1**	Formation of partial differential equation by eliminating arbitrary functions of the form $\phi(u,v)=0$	Fourier series –related problems in $(-l,l)$	One dimensional Wave Equation-initial displacement with zero initial velocity-type 2 Trigonometric function	Fourier Sine Transforms - problems	Z-transform of $\frac{1}{n^2}, \frac{1}{(n+1)^2}$
	SLO-2	Solution of first order non linear partial differential equations-standard type I F(p,q)=o	Fourier series –half range cosine series related problems $(0,\pi)$	One dimensional Wave Equation-initial displacement with zero initial velocity-type 3 – Midpoint of the string is displaced	Fourier Cosine Transforms - problems	Z-transform of $r^n \cos n\theta$
S-4	**SLO-1**	**Problem solving using tutorial sheet 1**	**Problem solving using tutorial sheet 4**	**Problem solving using tutorial sheet 7**	**Problem solving using tutorial sheet 10**	**Problem solving using tutorial sheet 13**
	SLO-2	**Problem solving using tutorial sheet 1**	**Problem solving using tutorial sheet 4**	**Problem solving using tutorial sheet 7**	**Problem solving using tutorial sheet 10**	**Problem solving using tutorial sheet 13**
S-5	**SLO-1**	Solution of first order non linear partial differential equations-standard type –II Clairaut's form	Fourier series –half range cosine series related problems $(0,l)$	One dimensional Wave Equation-initial displacement with non-zero initial velocity Type 1 Algebraic function	Properties of Fourier sine Transforms	Z-transform of $r^n \sin n\theta$
	SLO-2	Solution of first order non linear partial differential equations-standard type III F(z, p, q)=o	Fourier series –half range sine series related problems $(0,\pi)$	One dimensional Wave Equation-initial displacement with non-zero initial velocity Type 2 Trigonometric function	Fourier sine Transforms applications	Initial value theorem
S-6	**SLO-1**	Solution of first order non linear partial differential equations-standard type-IV separation of variable f(x, p) = g(y, q)	Fourier series –half range sine series related problems $(0,l)$	Wave Equation-initial displacement with non-zero initial velocity Type 3 split function	Properties of Fourier cosine Transforms	Final value theorem
	SLO-2	Lagrange's linear equation: Method of grouping	Parseval's Theorem (without proof)-related problems in Fourier series	One dimensional heat equation and its possible solutions	Fourier cosine Transforms applications	Inverse Z-transform- long division method
S-7	**SLO-1**	Lagrange's linear equation: Method of multipliers	Parseval's Theorem (without proof)-related problems in cosine series	One dimensional heat equation related problems	Convolution of two function	Inverse Z-transform, related problems, long division method
	SLO-2	More problems in Lagrange's linear equation: Method of multipliers	Parseval's Theorem (without proof)-related problems in sine series	One dimensional heat equation - Steady state conditions	Convolution Theorem	Inverse Z-transform, Partial fraction method
S-8	**SLO-1**	**Problem solving using tutorial sheet 2**	**Problem solving using tutorial sheet 5**	**Problem solving using tutorial sheet 8**	**Problem solving using tutorial sheet 11**	**Problem solving using tutorial sheet 14**
	SLO-2	**Problem solving using tutorial sheet 2**	**Problem solving using tutorial sheet 5**	**Problem solving using tutorial sheet 8**	**Problem solving using tutorial sheet 11**	**Problem solving using tutorial sheet 14**
S-9	**SLO-1**	Linear Homogeneous partial differential equations of second and higher order with constant coefficients-CF and PI Type 1: e^{ax+by}	Introduction to Harmonic Analysis	One dimensional heat equation - Steady state conditions more problems	Parseval's Identity for Fourier transform	Inverse Z-transform, Partial fraction method related problems
	SLO-2	PI Type2.:**sin(ax+by) or cos(ax+by)**	Harmonic Analysis for finding harmonic in $(0,2\pi)$	One dimensional heat equation - Steady state conditions with zero velocity	Parseval's Identity for Fourier sine & cosine transforms	Inverse Z-transform - residue theorem method
S-10	SLO-1	PI Type 3: polynomials	Harmonic Analysis for finding harmonic in $(0,2l)$	One dimensional heat equation - Steady state conditions with zero velocity more problems	Parseval's Identity for Fourier sine & cosine transforms applications	Inverse Z-transform - residue theorem method-problems

	SLO-2	PI Type 4 :Exponential shifting - $e^{ax+by} f(x,y)$	Harmonic Analysis for finding harmonic in periodic interval $(0,T)$	One dimensional heat equation - Steady state conditions with zero velocity more related problems	Fourier Transforms Using Differentiation property	Convolution theorem (without proof)
S-11	SLO-1	Linear Homogeneous partial differential equations of second and higher order with constant coefficients type 5 General rule	Harmonic Analysis for finding cosine series	Steady state conditions and Non-zero boundary conditions- related problems	Solving integral equation	Convolution theorem applications
	SLO-2	**Applications of Partial differential equations in Engineering**	Harmonic Analysis for finding sine series	Steady state conditions and Non-zero boundary conditions- more related problems	Self reciprocal using Fourier Transform, sine and cosine transform	Solution of linear difference equations with constant coefficients using Z-transform
S-12	SLO-1	**Problem solving using tutorial sheet 3**	**Problem solving using tutorial sheet 6**	**Problem solving using tutorial sheet 9**	**Problem solving using tutorial sheet 12**	**Problem solving using tutorial sheet 15**
	SLO-2	**Problem solving using tutorial sheet 3**	**Problem solving using tutorial sheet 6**	**Problem solving using tutorial sheet 9**	**Problem solving using tutorial sheet 12**	**Problem solving using tutorial sheet 15**

Learning Resources

1. Erwin kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2006.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2015.
3. Veerarajan T., Transforms and Partial Differential Equations, Tata McGraw-Hill, New Delhi, 3rd edition,2012.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 2010 3rd Edition.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, New Delhi,Reprint,3rd edition,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	*40%*		*30%*		*30%*		*30%*		*30%*	
	Understand										
Level 2	Apply	*40%*		*40%*		*40%*		*40%*		*40%*	
	Analyze										
Level 3	Evaluate	*20%*		*30%*		*30%*		*30%*		*30%*	
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, etc.,

Course Designers

(a) Experts from Industry

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

(b) Experts from Higher Technical Institutions

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

(b) Internal Experts

4	***Dr.A.Govindarajan***	***SRMIST***	**govindarajan.a@ktr.srmuniv.ac.in**	5	***Prof.K.Ganapathy subramanian***	***SRMIST***	***ganapatk@srmist.edu.in***

Course Code	19PCSC11J	Course Name	PROGRAMMING FOR PROBLEM SOLVING	Course Category	C	Professional Core	L	T	P	C
							3	0	2	4

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

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

		Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Think and evolve a logically to construct an algorithm into a flowchart and a pseudocode that can be programmed			
CLR-2 :	Utilize the logical operators and expressions 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 files to store and retrieve information			
CLR-6 :	Create a logical mindset to solve various engineering applications using programming constructs in C			

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 :	Identify methods to solve a problem through computer programming. List the basic data types and variables in C	2	85	80	L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
CLO-2 :	Apply the logic operators and expressions. Use loop constructs and recursion. Use array to store and retrieve data	3	85	80	L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
CLO-3 :	Analyze programs that need storage and form single and multi-dimensional arrays. Use preprocessor constructs in C	3	85	80	L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
CLO-4 :	Create user defined functions for mathematical and other logical operations. Use pointer to address memory and data	3	85	80	L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
CLO-5 :	Create structures and unions to represent data constructs. Use files to store and retrieve data	3	85	80	L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
CLO-6 :	Apply programming concepts to solve problems. Learn about how C programming can be effectively used for solutions	3	85	80	L	H	H	H	H	-	-	M	M	L	-	H	-	-	-

Duration (hour)		15	15	15	15	15
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 4-5	SLO-1	***Lab 1: Algorithm, Flow Chart,***	***Lab 4: Operators and Expressions***	***Lab 7: Arrays - Multidimensional***	***Lab 10: Functions***	***Lab 13: Structures & Unions***
	SLO-2	***Pseudocode***				
S-6	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-7	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-8	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 9-10	SLO-1	*Lab 2: Input and Output Statements*	*Lab 5: Control Statements*	*Lab 8: Strings*	*Lab 11: Pointers*	*Lab 14: Structures & Unions*
	SLO-2					
S-11	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-12	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-13	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 14-15	SLO-1	*Lab 3: Data Types*	*Lab 6: Arrays – One Dimensional*	*Lab 9: Functions*	*Lab 12: Pointers*	*Lab 15: File Handling*
	SLO-2					

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	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sainarayanan Gopalakrishnan, HCL Technologies, sai.jgk@gmail.com	***1. Prof. Janakiram D, IIT Madras, djram@iitm.ac.in***	***1. Dr. Christhu Raj M R, SRMIST***
2. Dr. Sricharan Srinivasan, Wipro Technologies, sricharanms@gmail.com	***2. Dr. Rajeev Sukumaran, IIT Madras, rajeev@wmail.iitm.ac.in***	***2. Dr. B. Amutha, SRMIST***

Course Code	19PCSC12T	Course Name	COMPUTER ORGANIZATION AND ARCHITECTURE	Course Category	C	Professional Core	L	T	P	C
							3	0	0	3

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Utilize the functional units of a computer			
CLR-2 :	Analyze the functions of arithmetic Units like adders, multipliers etc.			
CLR-3 :	Understand the concepts of Pipelining and basic processing units			
CLR-4 :	Study about parallel processing and performance considerations.			
CLR-5 :	Have a detailed study on Input-Output organization and Memory Systems.			
CLR-6 :	Simulate simple fundamental units like half adder, full adder etc			

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 :	Identify the computer hardware and how software interacts with computer hardware	2	80	70	H	H	-	-	-	-	-	-	M	L	-	M	-	-	-
CLO-2 :	Apply Boolean algebra as related to designing computer logic, through simple combinational and sequential logic circuits	3	85	75	H	H	H	-	H	-	-	-	M	L	-	M	-	-	-
CLO-3 :	Analyze the detailed operation of Basic Processing units and the performance of Pipelining	2	75	70	H	H	H	H	-	-	-	-	M	L	-	M	-	-	-
CLO-4 :	Analyze concepts of parallelism and multi-core processors.	3	85	80	H	-	-	H	-	-	-	-	M	L	-	M	-	-	-
CLO-5 :	Identify the memory technologies, input-output systems and evaluate the performance of memory system	3	85	75	H	-	H	H	-	-	-	-	M	L	-	M	-	-	-
CLO-6 :	Identify the computer hardware, software and its interactions	3	85	75	H	H	H	H	H	-	-	-	M	L	-	M	-	-	-

Duration (hour)		9	9	9	9	9
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**
	SLO-2					
S-4	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-5	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-6	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-7	**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-8	**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-9	**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*

Learning Resources	1. *Carl Hamacher, Zvonko Vranesic, 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	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*		*30%*		*30%*		*30%*		*30%*	
	Understand										
Level 2	Apply	*40%*		*40%*		*40%*		*40%*		*40%*	
	Analyze										
Level 3	Evaluate	*20%*		*30%*		*30%*		*30%*		*30%*	
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, 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	19PCSC13J	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 Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Utilize the different data types; Utilize searching and sorting algorithms for data search
CLR-2 :	Utilize linked list in developing applications
CLR-3 :	Utilize stack and queues in processing data for real-time applications
CLR-4 :	Utilize tree data storage structure for real-time applications
CLR-5 :	Utilize algorithms to find shortest data search in graphs for real-time application development
CLR-6 :	Utilize the different types of data structures and its operations for real-time programming applications

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning 1: Level of Thinking (Bloom)	Learning 2: Expected Proficiency (%)	Learning 3: Expected Attainment (%)	PLO 1: Engineering Knowledge	PLO 2: Problem Analysis	PLO 3: Design & Development	PLO 4: Analysis, Design, Research	PLO 5: Modern Tool Usage	PLO 6: Society & Culture	PLO 7: Environment & Sustainability	PLO 8: Ethics	PLO 9: Individual & Team Work	PLO 10: Communication	PLO 11: Project Mgt. & Finance	PLO 12: Life Long Learning	PSO 1	PSO 2	PSO 3
CLO-1 :	Identify linear and non-linear data structures. Create algorithms for searching and sorting	3	80	70	L	H	-	H	L	-	-	-	L	L	-	H	-	-	-
CLO-2 :	Create the different types of linked lists and evaluate its operations	3	85	75	M	H	L	M	L	-	-	-	M	L	-	H	-	-	-
CLO-3 :	Construct stack and queue data structures and evaluate its operations	3	75	70	M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
CLO-4 :	Create tree data structures and evaluate its types and operations	3	85	80	M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
CLO-5 :	Create graph data structure, evaluate its operations, implement algorithms to identify shortest path	3	85	75	H	H	M	H	L	-	-	-	M	L	-	H	-	-	-
CLO-6 :	Construct the different data structures and evaluate their types and operations	3	80	70	L	H	-	H	L	-	-	-	L	L	-	H	-	-	-

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	Lab4 :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 SLO-2	Lab 2: Implementation of sorting Techniques – Insertion sort and Bubble	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

		Sort Techniques				
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	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, 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*
2. Dr. Sricharan Srinivasan, Wipro Technologies, sricharanms@gmail.com	*2. Dr. Ramesh Babu, N , nrbabu@iitm.ac.in*	*2. Dr.Subalalitha C.N, SRMIST*
	3. Dr.Noor Mahammad, IIITDM, Kancheepuram,noor@iiitdm.ac.in	*3. Ms. Ferni Ukrit, SRMIST*

Course Code	19PMAB03T	Course Name	DISCRTE MATHEMATICS FOR ENGINEERS	Course Category	B	Basic Sciences	L	T	P	C
							3	1	0	4

Pre-requisite Courses	19PMAB01T	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mathematics	Data Book / Codes/Standards	nil		

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

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

		Learning Unit / Module 1	Learning Unit / Module 2	Learning Unit / Module 3	Learning Unit / Module 4	Learning Unit / Module 5
Duration (hour)		12	12	12	12	12
S-1	SLO-1	Sets and examples. Operations on sets.	Permutation and Combination	Propositions and Logical operators	Binary operation on a set- Groups and axioms of groups.	Basic concepts - Basic Definitions- degree and Hand shaking theorem.
	SLO-2	Laws of Set theory- Proving set identities using laws of set theory.	Simple problems using addition and product rules.	Truth values and truth tables.	Properties of groups.	Some Special Graphs – complete, regular and bipartite graphs.
S-2	SLO-1	Partition of a set – examples.	Principle of inclusion and exclusion	Propositions generated by a set- Symbolic writing using conditional and biconditional connectives.	Permutation group, equivalence classes with addition modulo m and multiplication modulo m.	Isomorphism of graphs – necessary conditions.
	SLO-2	Cartesian product of sets.	Problems using inclusion and exclusion principle.	Writing converse inverse and contra positive of a given conditional.	Cyclic groups and properties.	Isomorphism- simple examples.
S-3	SLO-1	Relations – Properties.	Pigeon-hole principle and generalized pigeon-hole principle.	Tautology, contradiction and contingency-examples.	Subgroups and necessary and sufficiency of a subset to be a subgroup.	***Paths, cycles and circuits.***
	SLO-2	Equivalence relation and partial order relation	Problems on pigeon-hole principle.	Proving tautology and contradiction using truth table method.	**Group homomorphism and properties.**	***Connectivity in undirected graphs – connected graphs and odd degree vertices.***
S-4	SLO-1	**Problem solving using tutorial sheet 1**	**Problem solving using tutorial sheet 4**	**Problem solving using tutorial sheet 7**	**Problem solving using tutorial sheet 10**	**Problem solving using tutorial sheet 13**
	SLO-2					
S-5	SLO-1	Poset - Graphs of relations Digraphs	Divisibility and prime numbers.	Equivalences – truth table method to prove equivalences.	Rings- definition and examples..Zero devisors.	Eulerian and Hamiltonian graphs.
	SLO-2	Hasse diagram – problems.	Fundamental theorem of arithmetic – problems.	Implications- truth table method to prove implications.	Integral domain- definition , examples and properties.	Necessary and sufficient condition for a graph to be Eulerian- examples.
S-6	SLO-1	*Closures of relations- examples*	Finding prime factorization of a given number.	Laws of logic and some equivalences.	Fields – definition, examples and properties.	Matrix representation of graphs- adjacent and incidence matrices and examples.

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

Learning Resources

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

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40%*		*30%*		*30%*		*30%*		*30%*	
Level 2	Apply Analyze	*40%*		*40%*		*40%*		*40%*		*40%*	
Level 3	Evaluate Create	*20%*		*30%*		*30%*		*30%*		*30%*	
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, etc.,

Course Designers

(a) Experts from Industry

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

(b) Experts from Higher Technical Institutions

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(b) Internal Experts

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

Course Code	19PCSC14J	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 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 :	Utilize class and build domain model for real-time programs			
CLR-2 :	Utilize method overloading and operator overloading for real-time application development programs			
CLR-3 :	Utilize inline, friend and virtual functions and create application development programs			
CLR-4 :	Utilize exceptional handling and collections for real-time object oriented programming applications			
CLR-5 :	Construct UML component diagram and deployment diagram for design of applications			
CLR-6 :	Create programs using object oriented approach and design methodologies for real-time application development			

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 :	Identify the class and build domain model	3	80	70	H	H	M	-	-	-	-	-	H	H	-	-	M	H	H
CLO-2 :	Construct programs using method overloading and operator overloading	3	85	75	H	H	H	H	H	-	M	-	H	H	-	-	M	H	H
CLO-3 :	Create programs using inline, friend and virtual functions, construct programs using standard templates	3	75	70	H	H	M	H	H	-	M	-	H	H	-	-	M	H	H
CLO-4 :	Construct programs using exceptional handling and collections	3	85	80	H	H	H	-	-	-	-	-	H	M	-	-	M	H	H
CLO-5 :	Create UML component diagram and deployment diagram	3	85	75	H	M	M	M	M	M	M	-	H	H	-	M	M	H	H
CLO-6 :	Create programs using object oriented approach and design methodologies	3	80	70	H	H	M	-	-	-	-	-	H	H	-	-	M	H	H

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 4-5	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
	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 SLO-2	*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*

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%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. Girish Raghavan, Senior DMTS Member, Wipro Ltd.	*1. Dr. Srinivasa Rao Bakshi, IITM Chennai, sbakshi@iitm.ac.in*	*1. Ms. C.G.Anupama, SRMIST*
Ms. Thamilchelvi, Solutions Architect, Wipro Ltd	*2. Dr. Ramesh Babu, N, IITM Chennai, nrbabu@iitm.ac.in*	*2. Mr. C.Arun, SRMIST*
		3. Mr. Geogen George, SRMIST
		4. Mr. Muthukumaran, SRMIST

Course Code	19PCSC15J	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 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 :	Design efficient algorithms in solving complex real time problems			
CLR-2 :	Analyze various algorithm design techniques to solve real time problems in polynomial time			
CLR-3 :	Utilize various approaches to solve greedy and dynamic algorithms			
CLR-4 :	Utilize back tracking and branch and bound paradigms to solve exponential time problems			
CLR-5 :	Analyze the need of approximation and randomization algorithms, utilize the importance Non polynomial algorithms			
CLR-6 :	Construct algorithms that are efficient in space and time complexities			

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 :	Apply efficient algorithms to reduce space and time complexity of both recurrent and non-recurrent relations	3	80	70	L	H	-	H	L	-	-	-	L	L	-	H	-	-	-
CLO-2 :	Solve problems using divide and conquer approaches	3	85	75	M	H	L	M	L	-	-	-	M	L	-	H	-	-	-
CLO-3 :	Apply greedy and dynamic programming types techniques to solve polynomial time problems.	3	75	70	M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
CLO-4 :	Create exponential problems using backtracking and branch and bound approaches.	3	85	80	M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
CLO-5 :	Interpret various approximation algorithms and interpret solutions to evaluate P type, NP Type, NPC, NP Hard problems	3	85	75	H	H	M	H	L	-	-	-	M	L	-	H	-	-	-
CLO-6 :	Create algorithms that are efficient in space and time complexities by using divide conquer, greedy, backtracking technique	3	80	70	L	H	M	H	L	-	-	-	L	L	-	H	-	-	-

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	$O, O, \Theta, \omega, \Omega$	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%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, 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*
2. Dr.SainarayananGopalakrishnan, HCL Technologies, sai.jgk@gmail.com	*2. V. Masilamani. IIITDM, masila@iiitdm.ac.in*	*2. Dr.A.Razia Sulthana, SRMIST*
		3. Mr. V. Sivakumar, SRMIST
		4. Ms. R. Vidhya, SRMIST

Course Code	19PCSC16T	Course Name	SOFTWARE ENGINEERING AND PROJECT MANAGEMENT	Course Category	C	Professional Core	L	T	P	C
							3	0	0	3

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Familiarize the software life cycle models and software development process
CLR-2 :	Understand the various techniques for requirements, planning and managing a technology project
CLR-3 :	Examine basic methodologies for software design, development, testing, closure and implementation
CLR-4 :	Understand manage users expectations and the software development team
CLR-5 :	Acquire the latest industry knowledge, tools and comply to the latest global standards for project management

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning 1 Level of Thinking (Bloom)	Learning 2 Expected Proficiency (%)	Learning 3 Expected Attainment (%)
CLO-1 :	Identify the process of project life cycle model and process	1	85	80
CLO-2 :	Analyze and specify software requirements through a productive working Relationship with project stakeholders	2	80	75
CLO-3 :	Design the system based on Functional Oriented and Object Oriented Approach for Software Design.	3	85	85
CLO-4 :	Develop the correct and robust code for the software products	3	85	85
CLO-5 :	Perform by applying the test plan and various testing techniques	2	85	75

Program Learning Outcomes (PLO)	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	13 PSO - 1	14 PSO - 2	15 PSO – 3
CLO-1 :	H	H	L	-	-	-	L	-	H	H	M	M	-	-	-
CLO-2 :	H	H	H	H	H	-	M	-	H	H	H-	M	-	-	-
CLO-3 :	H	H	M	H	H	M	M	L	H	H	M	-	-	-	-
CLO-4 :	H	H	H	-	H	-	-	M	H	M	H	-	-	-	-
CLO-5 :	H	M	M	M	M	M	M	-	H	H	-	M	-	-	-

Duration (hour)		9	9	9	9	9
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	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-5	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-6	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-7	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-8	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-9	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

Learning Resources	1. *Roger S. Pressman, Software Engineering – A Practitioner Approach, 6th ed., McGraw Hill, 2005* 2. *Ian Sommerville, Software Engineering, 8th ed., Pearson Education, 2010* 3. *Rajib Mall, Fundamentals of Software Engineering, 4th ed., PHI Learning Private Limited, 2014* 4. *Ramesh, Gopalaswamy, Managing Global Projects, Tata McGraw Hill, 2005*	5. *Ashfaque Ahmed, Software Project Management: a process-driven approach, Boca Raton, Fla: CRC Press, 2012* 6. *Walker Royce, Software Project Management, Pearson Education, 1999* 7. *Jim Smith Agile Project Management: Creating Innovative Products,Pearson 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	Practice
Level 1	Remember	*40%*		*30%*		*30%*		*30%*		*30%*	
	Understand										
Level 2	Apply	*40%*		*40%*		*40%*		*40%*		*40%*	
	Analyze										
Level 3	Evaluate	*20%*		*30%*		*30%*		*30%*		*30%*	
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, 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	19PCSC21J	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 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 :	Introduce the key role of an Operating system			
CLR-2 :	Insist the Process Management functions of an Operating system			
CLR-3 :	Emphasize the importance of Memory Management concepts of an Operating system			
CLR-4 :	Realize the significance of Device Management part of an Operating system			
CLR-5 :	Comprehend the need of File Management functions of an Operating system			
CLR-6 :	Explore the services offered by the Operating system practically			

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 :	Identify the need of an Operating system	1	80	70	H	H	H	H	H	M	L	M	H	M	M	H	H	H	M
CLO-2 :	Know the Process management functions of an Operating system	1	85	75	H	H	H	H	H	M	L	M	H	M	M	H	H	H	M
CLO-3 :	Understand the need of Memory Management functions of an Operating system	1	75	70	H	H	H	H	H	M	L	M	H	M	M	H	H	H	M
CLO-4 :	Find the significance of Device management role of an Operating system	2	85	80	H	H	H	H	H	M	L	M	H	M	M	H	H	H	M
CLO-5 :	Recognize the essentials of File Management part of an Operating system	2	85	75	H	H	H	H	H	M	L	M	H	M	M	H	H	H	M
CLO-6 :	Gain an insight of Importance of an Operating system through practical	3	80	70	H	H	H	H	H	M	L	M	H	M	M	H	H	H	M

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	FILE SYSTEM IMPLEMENTATION : File system structure

					Techniques	
S-8	**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*
	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

	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%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, 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. ***Mr. Eliazer M, SRMIST***	

Course Code	19PCSC22J	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 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 :	Create Real-time Application Programs using structured, procedural and object oriented programming paradigms			
CLR-2 :	Create Real-time Application Programs using event driven, declarative and imperative programming paradigms			
CLR-3 :	Create Real-time Application Programs using parallel, concurrent and functional programming paradigms			
CLR-4 :	Create Real-time Application Programs using logic, dependent type and network programming paradigms			
CLR-5 :	Create Real-time Application Programs using symbolic, automata based and graphical user interface program paradigm			
CLR-6 :	Create Real-time Application Programs using different programming paradigms using python language			

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 :	Create Programs using structured, procedural and object oriented programming paradigms	3	85	80	H	H	H	H	H	-	-	L	M	M	L	M	-	M	-
CLO-2 :	Create Programs using event driven, declarative and imperative programming paradigms	3	85	80	H	H	H	H	H	-	-	L	M	M	L	M	-	-	-
CLO-3 :	Create Programs using parallel, concurrent and functional programming paradigms	3	85	80	H	H	H	H	H	-	-	L	M	M	L	M	-	-	-
CLO-4 :	Create Programs using logic, dependent type and network programming paradigms	3	85	80	H	H	H	H	H	-	-	L	M	M	L	M	-	-	-
CLO-5 :	Create Programs using symbolic, automata based and graphical user interface programming paradigms	3	85	80	H	H	H	H	H	-	-	L	M	M	L	M	-	-	-
CLO-6 :	Create Programs using different programming paradigms using python language	3	85	80	H	H	H	H	H	-	-	L	M	M	L	M	-	-	-

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	Lab 1: Structured Programming	Lab 4: Event Driven Programming	Lab 7: Parallel Programming	Lab 10: Logic Programming	Lab 13: Symbolic Programming
	SLO-2					
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	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, 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.* ***Dr. Christhu Raj M R, SRMIST*** *3. Ms. K. Sornalakshmi, SRMIST*
		4. Mr. C. Arun, SRMIST

Course Code	19PCSC23T	Course Name	FORMAL LANGUAGE AND AUTOMATA	Course Category	C	Professional Core	L	T	P	C
							3	1	0	4

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

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

		Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Utilize the mathematics and engineering principles for the basics of Formal Language*			
CLR-2 :	*Acquire knowledge of Automata and minimize with Regular language's*			
CLR-3 :	*Acquire knowledge of Context free Grammar and simplify using normal forms*			
CLR-4 :	*Gain knowledge to push down automata and apply it with CFL*			
CLR-5 :	*Analyze the methods of turning machine*			
CLR-6 :	*Analyze and Design the methods of computational complexity*			

Course Learning Outcomes (CLO): *At the end of this course, learners will be able to:*

		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 mathematics and engineering principles for the basics of Formal Language*	*M*	*H*	-	*H*	*L*	-	-	-	*L*	*L*	-	*H*	-	-	-
CLO-2 :	*Acquire the ability to identify specification of a Regular language's with Automata*	*M*	*H*	*L*	*M*	*L*	-	-	-	*M*	*L*	-	*H*	-	-	-
CLO-3 :	*Acquire knowledge of Context free Grammar and simplify using normal forms*	*M*	*H*	*M*	*H*	*L*	-	-	-	*M*	*L*	-	*H*	-	-	-
CLO-4 :	*Understand the concepts of push down automata and CFL .*	*M*	*H*	*M*	*H*	*L*	-	-	-	*M*	*L*	-	*H*	-	-	-
CLO-5 :	*Apply the knowledge to turning machine and its methods*	*H*	*H*	*M*	*H*	*L*	-	-	-	*M*	*L*	-	*H*	-	-	-
CLO-6 :	*Design the computational and acceptor machines using FA, PDA and Turing machines*	*L*	*H*	-	*H*	*L*	-	-	-	*L*	*L*	-	*H*	-	-	-

Duration (hour)		**12**	**12**	**12**	**12**	**12**
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*	*examples*	*Problems related to DPDA*	*Problems related to turning machine as Acceptors*	*Rice's Theorem*
S-3	SLO-1	*Problems related to regular expressions*	*Ambiguity*	*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*	*Examples*	*Problems related to NDPDA*		
S-4	SLO-1	*Nondeterministic Finite Automata*	*Relationship between derivation and derivation trees*	*Problems related to DPDA and NDPDA*	*Turing Machine as a Computing Device*	*Problems related to Post's Correspondence Problem*
	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*	*Problems related to Context free Grammar*	*Pushdown automata to CFL Equivalence*	*Problems related to turning Turing Machine as a Computing Device*	*Properties of Recursive and Recursively enumerable languages*
	SLO-2	*Problems related to Finite Automaton with €- moves*				
S-6	SLO-1	*Equivalence of NFA and DFA*	*Simplification of CFG : Elimination of Useless Symbols*	*Problems related to Equivalence of PDA to CFG*	*Techniques for Turing Machine Construction*	*Introduction to Computational Complexity: Definitions*
	SLO-2	*Heuristics to Convert NFA to DFA*				
S-7	SLO-1	*Equivalence of NDFA's with and without €-moves*	*Simplification of CFG : Unit productions*	*Problems related to Equivalence of PDA to CFG*	*Considering the state as a tuple Considering the tape symbol as a tuple*	*Time and Space complexity of TMs*
	SLO-2	*Problems related Equivalence of NDFA's with and without €-moves*	*Simplification of CFG : Null productions*			
S-8	SLO-1	*Minimization of DFA*	*Problems related to Simplification of CFG*	*CFL to Pushdown automata Equivalence*	*Checking off symbols*	*Complexity classes: Class P,*

	SLO-2	*Problems related to Minimization of DFA*				
S-9	SLO-1	*Regular Languages : Equivalence of Finite Automata and Regular Languages*	*Chomsky normal form*	*Problems related to Equivalence of CFG to PDA*	*Modifications of Turing Machine*	*Class NP*
	SLO-2	*Equivalence of Finite Automata and Regular Grammars*				
S-10	SLO-1	*Problems related to Equivalence of Finite Automata and Regular Languages and Regular Grammars*	*Problems related to CNF*	*Pumping lemma for CFL*	*Multi-tape Turing Machine*	*Complexity classes: Introduction to NP-Hardness*
	SLO-2	*Variants of Finite Automata :Two-way Finite Automaton Mealy Machines*				
S-11	SLO-1	*Properties of Regular Languages: Closure Properties*	*Greiback Normal form*	***Pumping lemma for CFL***	*Non-Deterministic Turing Machine*	*NP Completeness*
	SLO-2	*Set Theoretic Properties & Other Properties*	*Problems related to GNF*			
S-12	SLO-1	*Pumping Lemma*	*Problems relating to Grammars*	*Problems based on pumping Lemma*	*Semi-Infinite Tape Turing Machine*	*Problems*
	SLO-2	*Exercises*				

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 Understand	*40%*		*30%*		*30%*		*30%*		*30%*	
Level 2	Apply Analyze	*40%*		*40%*		*40%*		*40%*		*40%*	
Level 3	Evaluate Create	*20%*		*30%*		*30%*		*30%*		*30%*	
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, etc.,

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

Course Code	19PCSC26T	Course Name	COMPUTER COMMUNICATIONS	Course Category	C	Professional Core	L	T	P	C
							3	0	0	3

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understand the basic services and concepts related to Internetwork
CLR-2 :	Understand the layered network architecture
CLR-3 :	Acquire knowledge in IP addressing
CLR-4 :	Exploring the services and techniques in physical layer
CLR-5 :	Understand the functions of Data Link layer
CLR-6 :	Implement and analyze the different Routing Protocols

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning 1 Level of Thinking (Bloom)	Learning 2 Expected Proficiency (%)	Learning 3 Expected Attainment (%)
CLO-1 :	Apply the knowledge of communication	2	80	70
CLO-2 :	Identify and design the network topologies	3	85	75
CLO-3 :	Design the network using addressing schemes	3	75	70
CLO-4 :	Identify and correct the errors in transmission	1	85	80
CLO-5 :	Identify the guided and unguided transmission media	1	85	75
CLO-6 :	Design and implement the various Routing Protocols	3	80	70

Course Learning Outcomes (CLO):	PLO 1 Engineering Knowledge	PLO 2 Problem Analysis	PLO 3 Design & Development	PLO 4 Analysis, Design, Research	PLO 5 Modern Tool Usage	PLO 6 Society & Culture	PLO 7 Envronment & Sustainability	PLO 8 Ethics	PLO 9 Individual & Team Work	PLO 10 Communication	PLO 11 Project Mgt. & Finance	PLO 12 Life Long Learning	PLO 13 PSO - 1	PLO 14 PSO - 2	PLO 15 PSO – 3
CLO-1 :	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	H	-	H	-	-	-	-	-	-	-	-	-	M	-	-
CLO-3 :	H	H	-	-	-	-	-	-	-	-	-	-	M	-	M
CLO-4 :	H	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-6 :	H	H	H	H	H	-	-	-	-	-	-	-	M	-	M

Duration (hour)		9	9	9	9	9
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	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-5,6	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	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-9	SLO-1	Serial and Parallel Transmissions	Bridge	Microwaves	HDLC	EIGRP
	SLO-2	Addressing	Structure of Router	Infrared	PPP	BGP

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	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*		*30%*		*30%*		*30%*		*30%*	
	Understand										
Level 2	Apply	*40%*		*40%*		*40%*		*40%*		*40%*	
	Analyze										
Level 3	Evaluate	*20%*		*30%*		*30%*		*30%*		*30%*	
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, 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, Dr. J.S. Femilda Josephin, SRMIST SRMIST*

Course Code	19PCSC24J	Course Name	COMPUTER NETWORKS	Course Category	C	Professional Core	L	T	P	C
							3	0	2	4

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

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

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 Proficie	ηCV(%)	Engineering KnoWledge	Problem Analysis		Design&Develop ment				Analysis,Design, Research	Modern Tool Usage	Society&Culture		Environm ent&Susta inability		Ethics	Individual &
CLO-1 :	Acquire the basics of computer network and its architecture	3	80	70	L	H	-	H	L	-	-	-	L	L	-	H	-	-	-
CLO-2 :	Acquire the knowledge of various networks devices and addressing methods	3	85	75	M	H	L	M	L	-	-	-	M	L	-	H	-	-	-
CLO-3 :	Abilty to design the network routing methods	3	75	70	M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
CLO-4 :	Acquire the various error codes and framing concepts	3	85	80	M	H	M	H	L	-	-	-	M	L	-	H	-	-	-
CLO-5 :	Ability to understand the physical layer functions and components	3	85	75	H	H	M	H	L	-	-	-	M	L	-	H	-	-	-
CLO-6 :		3	80	70	L	H	-	H	L	-	-	-	L	L	-	H	-	-	-

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

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

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

Learning Assessment

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

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, etc.,

Course Designers

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

Course Code	19PCSC25J	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 Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Provide a broad understanding of the basic techniques for building intelligent computer systems and an understanding of how AI is applied to problems.
CLR-2 :	Gain knowledge in problem formulation and building intelligent agents
CLR-3 :	Understand the search technique procedures applied to real world problems
CLR-4 :	Understand the types of logic and knowledge representation schemes
CLR-5 :	Acquire knowledge in planning and learning algorithms
CLR-6 :	Gain knowledge in AI Applications and advances in Artificial Intelligence

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 :	Formulate a problem and build intelligent agents	1	80	70	M	M	M	M	H	-	-	-	M	L	-	H	L	L	L
CLO-2 :	Apply appropriate searching techniques to solve a real world problem	2	85	75	M	H	H	H	H	-	-	-	M	L	-	H	M	L	M-
CLO-3 :	Analyze the problem and infer new knowledge using suitable knowledge representation schemes	2	75	70	M	H	H	M	H	-	-	-	M	L	-	H	M	L	M
CLO-4 :	Develop planning and apply learning algorithms on real world problems	2	85	80	M	H	M	H	H	-	-	-	M	L	-	H	M	M	M
CLO-5 :	Design an expert system and implement natural language processing techniques	3	85	75	M	H	H	H	H	-	-	-	M	L	-	H	H	M	H
CLO-6 :	Implement advance techniques in Artificial Intelligence	3	80	70	L	H	M	M	H	-	-	-	H	L	-	H	H	M	H

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 SLO-2	*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*
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-2	*Crypto arithmetic puzzles*	*Game playing and knowledge structure*	*Probabilistic reasoning over time*	*Multi_agent based learning*	*Business intelligence and analytics*
S-12	SLO-1	*CSP as a search problem-constrains and representation*	*Game as a search problem-Minimax approach*	*Forward and backward reasoning*	*Ensemble learning*	*Sentiment Analysis*
	SLO-2	*CSP-Backtracking, Role of heuristic*	*Minimax 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 minimax 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.*

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,1st ed.,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	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
Level 2	Apply Analyze	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
Level 3	Evaluate Create	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, 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.	*2.*	*2. Dr.G..Vadivu, SRMIST*
	3.	*3. Dr.C.Lakshmi, SRMIST*

Course Code	19PCSC31J	Course Name	COMPILER DESIGN	Course Category	C	Professional Core	L	T	P	C
							3	0	2	4

Pre-requisite Courses	19PCSC23T	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
		LevelofThinking (Bloom)	ExpectedProficiency (%)	ExpectedAttainment(%)
CLR-1 :	Utilize the mathematics and engineering principles for the Design of Compilers			
CLR-2 :	Acquire knowledge of Lexical Analyzer from a specification of a language's lexical rules			
CLR-3 :	Acquire knowledge of Syntax Analyzer for parsing the sentences in a compiler grammar			
CLR-4 :	Gain knowledge to translate a system into various intermediate codes			
CLR-5 :	Analyze the methods of implementing a Code Generator for compilers			
CLR-6 :	Analyze and Design the methods of developing a Code Optimizer			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:				Program Learning Outcomes (PLO)														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
					EngineeringKnowledge	ProblemAnalysis	Design&Development	Analysis,Design, Research	ModernTool Usage	Society&Culture	Environment& Sustainability	Ethics	Individual & TeamWork	Communication	ProjectMgt.&Finance	LifeLongLearning	PSO-1	PSO-2	PSO– 3
CLO-1 :	Acquire the knowledge of mathematics and engineering principles for the Design of Compilers	3	80	70	H	H	H	H	M	L	L	L	M	M	L	H	H	H	H
CLO-2 :	Acquire the ability to identify specification of a language's lexical rules of Lexical Analyzer	3	85	75	H	H	H	H	M	L	L	L	M	M	L	H	H	H	H
CLO-3 :	Apply the knowledge of Syntax Analyzer for parsing the sentences in a compiler grammar	3	75	70	H	H	H	H	M	L	L	L	M	M	L	H	H	H	H
CLO-4 :	Understand the concepts of translation of various intermediate codes .	3	85	80	H	H	H	H	M	L	L	L	M	M	L	H	H	H	H
CLO-5 :	Apply the knowledge to implement Code Generator for compilers	3	85	75	H	H	H	H	M	L	L	L	M	M	L	H	H	H	H
CLO-6 :	Analyze and Design the methods of developing a Code Optimizer	3	80	70	H	H	H	H	M	L	L	L	M	M	L	H	H	H	H

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,NewYork,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	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		1. Ms.R.Jeya
		2. Mrs.J. Jeyasudha

Course Code	19PCSC32J	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 Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
CLR-1 :	Understand the fundamentals of Database Management Systems, Architecture and Languages	LevelofThinking (Bloom)	ExpectedProficiency (%)	ExpectedAttainment(%)
CLR-2 :	Conceive the database design process through ER Model and Relational Model			
CLR-3 :	Design Logical Database Schema and mapping it to implementation level schema through Database Language Features			
CLR-4 :	Familiarize queries using Structure Query Language (SQL) and PL/SQL			
CLR-5 :	Familiarize the Improvement of the database design using normalization criteria and optimize queries			
CLR-6 :	Understand the practical problems of concurrency control and gain knowledge about failures and recovery			
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*			
CLO-1 :	Acquire the knowledge on DBMS Architecture and Languages	3	80	70
CLO-2 :	Apply the fundamentals of data models to model an application's data requirements using conceptual modeling tools like ER diagrams	3	85	75
CLO-3 :	Apply the method to convert the ER model to a database schemas based on the conceptual relational model	3	75	70
CLO-4 :	Apply the knowledge to create, store and retrieve data using Structure Query Language (SQL) and PL/SQL	3	85	80
CLO-5 :	Apply the knowledge to improve database design using various normalization criteria and optimize queries	3	85	75
CLO-6 :	Appreciate the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures.	3	85	75

Program Learning Outcomes (PLO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
EngineeringKnowledge	Problem Analysis	Design&Development	Analysis,Design,Research	ModernTool Usage	Society&Culture	Environment& Sustainability	Ethics	Individual & TeamWork	Communication	ProjectMgt.&Finance	LifeLongLearning	PSO-1	PSO-2	PSO– 3
H	M	L	L	-	-	-	-	L	L	L	H	-	-	-
H	H	H	H	H	-	-	-	H	H	H	H	-	-	-
H	H	H	H	H	-	-	-	H	H	H	H	-	-	-
H	H	H	H	H	-	-	-	H	H	H	H	-	-	-
H	H	L	M	L	-	-	-	M	M	M	L	-	-	-
H	L	L	L	L	-	-	-	H	L	L	L			

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		serializability of transactions,
	SLO-2	Purpose of database system				testing for serializability, 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	Lab4 : Inbuilt functions in SQL on sample exercise.	Lab 7 : Join Queries on sample exercise.	Lab10: PL/SQL Procedures on sample exercise.	Lab 13: PL/SQL Exception Handling
	SLO-2	* The abstract of the project to construct database must be framed		* Frame and execute the appropriate DDL,DML,DCL,TCL for the project	* Frame and execute the appropriate Join Queries for the project	* Frame and execute the appropriate PL/SQL Procedures and Functions for the project
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, Savepoint*	*preservation,*	*related problems*
S 9-10	SLO-1 SLO-2	*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*
S-11	SLO-1 SLO-2	*Degrees of Data Abstraction*	*ER Diagram Issues* *Weak Entity*	*PL/SQL Concepts- Cursors*	*BCNF*	*Locking mechanism, solution to concurrency related problems*
S-12	SLO-1 SLO-2	*Database Users and DBA*	*Relational Model*	*Stored Procedure, Functions Triggers and Exceptional Handling*	*Multi- valued dependency,* *4NF*	*Deadlock*
S-13	SLO-1 SLO-2	*Database Languages*	*Conversion of ER to Relational Table*	*Query Processing*	*Join dependency and 5NF*	*two-phase locking protocol, Isolation, Intent locking*
S 14-15	SLO-1 SLO-2	*Lab 3: SQL Data Control Language Commands and Transaction control commands to the sample exercises* ** Identify the issues that can arise in a business perspective for the application*	*Lab 6: Nested Queries on sample exercise* ** Construction of Relational Table from the ER Diagram*	*Lab9: PL/SQL Conditional and Iterative Statements* ** Frame and execute the appropriate Nested Queries for the project*	*Lab 12: PL/SQL Cursors* ** Frame and execute the appropriate PL/SQL Conditional and Iterative Statements for the project*	*Lab 15 : * Frame and execute the appropriate PL/SQL Cursors and Exceptional Handling for the project* ** Demo of the project*

Learning Resources

1. *Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Database System Concepts*ll*, Sixth Edition, Tata McGraw Hill,2011.*
2. *Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems*ll*, 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. *SharadMaheshwari,IntroductiontoSQLandPL/SQL,2ed.,LaxmiPublications,2016.*
6. *RaghuramaKrishnan,JohannesGehrke,DatabaseManagementSystems,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	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
Level 2	Apply Analyze	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
Level 3	Evaluate Create	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, 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. Mr.Elizer, SRMIST*
		3. Mrs. Hemavathy, SRMIST

Course Code	19PCSC33T	Course Name	MACHINE LEARNING	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	CSE	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	To provide basic concepts of machine learning			
CLR-2 :	To provide deeper understanding of various tools and techniques for Machine learning Algorithms and outputs			
CLR-3 :	Understand and Implement the major classification techniques			
CLR-4 :	Understand and Implement the various Clustering Methods			
CLR-5 :	Learn and Understand the Tree based machine Learning Algorithms			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Understand the concepts of machine learning	2	80	85
CLO-2 :	Learn and understand machine tools and libraries of machine learning	2	75	80
CLO-3 :	Learn and understand the linear learning models and classification in machine learning	2	85	80
CLO-4 :	Understand the clustering techniques and their utilization in machine learning	2	80	75
CLO-5 :	Study the tree based machine learning techniques and to appreciate their capability	2	75	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 :	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	H	H	H	-	H	-	-	-	-	-	-	-	-	-	-
CLO-3 :	H	H	-	-	H	-	-	-	-	-	-	-	-	-	-
CLO-4 :	H	H	-	-	H	-	-	-	-	-	-	-	-	-	-
CLO-5 :	H	H	-	H	H	-	-	-	-	-	-	-	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Machine Learning: What and Why?	Platform for machine learning	Ridge Regression	Measuring (dis)similarity	Decision tree representation
	SLO-2	Types of Machine Learning	Machine learning python libraries		Evaluating output of clustering methods	
S-2	SLO-1	Supervised Learning	Scikit-learn	Maximum likeliwood estimation (least squares)	Spectral clustering	Basic decision tree learning algorithm
	SLO-2	Unsupervised Learning	training data – testing data – validation data		Hierarchical clustering	
S-3	SLO-1	Reinforcement learning	k-fold cross validation	principal component analysis	Agglomerative clustering	Inductive bias in decision tree
	SLO-2	The Curse of dimensionality	Features		Divisive clustering	
S-4	SLO-1	Over fitting and under fitting	Performance metrics	Bayesian classifier	Choosing the number of clusters	Decision tree construction
	SLO-2	linear regression	MSE, accuracy, confusion matrix, precision		Clustering datapoints and features	
S-5	SLO-1	Bias and Variance tradeoff	recall, F- score	Support vector machine	Bi-clustering	Issues in decision tree
	SLO-2	Testing – cross validation				
S-6	SLO-1	Regularization	Linear Regression with multiple variables	Support vector machine + kernels	Multi-view clustering	Classification and regression trees (CART)
	SLO-2	Learning Curve				
S-7	SLO-1	Classification	Logistic Regression	Multi class classification	K-Means clustering	Random Forest
	SLO-2	Error and noise				Random Forest with scikit-learn
S-8	SLO-1	Parametric vs. non-parametric models	spam filtering with logistic regression	K nearest neighbour classification	K-meloids clustering	Multivariate adaptive regression trees (MART)
	SLO-2					Introduction to Artificial Neural Networks
S-9	SLO-1	Linear Algebra for machine learning	Naive Bayes with scikit-learn	Application: face recognition with PCA	Application: image segmentation using K-means clustering	Perceptron learning
	SLO-2					

Learning Resources

1. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
2. Ethem Alpaydin, "Introduction to Machine Learning", Prentice Hall of India, 2005
3. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.
4. Sebastian Raschka, Vahid Mirjilili,"Python Machine Learning and deep learning", 2nd edition, kindle book, 2018
5. Carol Quadros,"Machine Learning with python, scikit-learn and Tensorflow", Packet Publishing, 2018.
6. Gavin Hackeling," Machine Learning with scikit-learn", Packet publishing, O'Reily, 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	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		Dr.G.Vadivu
		Dr. UshaKiruthika
		Mr.S.Joseph James

Course Code	19PCSC41T	Course Name	NETWORK SECURITY	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	CSE	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understand the basic concepts of networking devices
CLR-2 :	Understand the concept of IP security
CLR-3 :	Understand the various methods and protocols to maintain E-mail security
CLR-4 :	Understand the various methods and protocols to maintain web security
CLR-5 :	Understand security measures for wireless and cell phone communications

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning 1 Level of Thinking (Bloom)	2 Expected Proficiency (%)	3 Expected Attainment (%)
CLO-1 :	Acquire the knowledge of network devices used in data communication	2	80	85
CLO-2 :	Acquire the knowledge of IP security and ability to identify the IP security attack	2	75	80
CLO-3 :	Acquire the knowledge of Email security and ability to detect the attacks in e-mail	2	85	80
CLO-4 :	Acquire the knowledge of web security attack and prevention mechanism	2	80	75
CLO-5 :	Acquire the knowledge of wireless network security and prevention mechanism	2	75	85

Program Learning Outcomes (PLO)	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	13 PSO - 1	14 PSO - 2	15 PSO – 3
CLO-1 :	H									H					
CLO-2 :	H														
CLO-3 :	H														
CLO-4 :	H							H							
CLO-5 :	H							H							

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	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, 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	19PCSE21T	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	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	To provide deep understanding of basic concepts of digital image acquisition
CLR-2 :	T provide deep Understanding of various digital image enhancement techniques
CLR-3 :	Understand image restoration and segmentation methods
CLR-4 :	To provide understanding and implementation of image compression techniques
CLR-5 :	Provide understanding and knowledge of image recognition methods

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning 1 Level of Thinking (Bloom)	Learning 2 Expected Proficiency (%)	Learning 3 Expected Attainment (%)
CLO-1 :	Understand basics of digital images and tools for image processing	2	80	85
CLO-2 :	Learn and implement image Enhancement techniques	2	75	80
CLO-3 :	Understand and Learn image Restoration and Segmentation Methods	2	85	80
CLO-4 :	Understand and implement Image Compression techniques	2	80	75
CLO-5 :	Learn and Implement Image Recognition methods	2	75	85

Program Learning Outcomes (PLO)	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	13 PSO - 1	14 PSO - 2	15 PSO – 3
CLO-1 :	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	H	H	H	-	H	-	-	-	-	-	-	-	-	-	-
CLO-3 :	H	H	M	-	H	-	-	-	-	-	-	-	-	-	-
CLO-4 :	H	H	M	-	H	-	-	-	-	-	-	-	-	-	-
CLO-5 :	H	H	M	-	H	-	-	-	-	-	-	-	-	-	-

Duration (hour)		9	9	9	9	9
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 StandardsHuffman, 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 Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, 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	19PCSE22T	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 Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	To recognize the essential concepts of distributed system.
CLR-2 :	To comprehend about the communication that takes place in Distributed systems
CLR-3 :	To realize the necessity of synchronization, consistency and Fault tolerance in a Distributed System.
CLR-4 :	To value the Process management, File systems, Shared memory
CLR-5 :	To acquire apparent scheme regarding distributed object-oriented based systems

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 :	Characterize the fundamental hardware and software concepts of distributed systems.	*3*	*80*	*70*
CLO-2 :	Categorize layered protocols and comprehend the communications in distributed systems	*3*	*85*	*75*
CLO-3 :	Implement synchronization of distributed systems using various algorithms.	*3*	*75*	*70*
CLO-4 :	Demonstrate process scheduling and fault tolerance of distributed systems.	*3*	*85*	*80*
CLO-5 :	Evaluate various Distributed Object-Oriented based systems.	*3*	*85*	*75*

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
H	*M*	*M*	*H*	*H*	*M*	-	-	*H*	*M*	-	*H*	-	-	-
H	*M*	*H*	*M*	*H*	*M*	-	-	*H*	*M*	-	*H*	-	-	-
H	*H*	*H*	*H*	*H*	*M*	-	-	*H*	*M*	-	*H*	-	-	-
H	*H*	*H*	*H*	*H*	*M*	-	-	*H*	*M*	-	*H*	-	-	-
H	*H*	*H*	*M*	*H*	*M*	-	-	*H*	*M*	-	*H*	-	-	-

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	Reliable primitives	Bully Algorithm	Scheduling in Distributed Systems	Page Replacement
	SLO-2	System	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	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, 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	19PCSE23T	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 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 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 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 the knowledge on the components of storage infrastructure	3	80	70	M	-	-	-	-	-	-	-	L	-	-	M	-	-	-
CLO-2 :	Acquire the ability to evaluate storage architectures including storagesubsystems	3	85	75	M	M	M	M	-	-	-	-	L	-	-	H	-	-	-
CLO-3 :	Understand the business continuity, backup and recovery methods.	3	75	70	M	M	M	M	-	-	-	-	L	-	-	H	-	-	-
CLO-4 :	Appreciate the concepts of storage security and information security applied to virtual machine	3	85	80	M	M	L	L	-	-	-	-	M	-	-	H	-	-	-
CLO-5 :	Apply the knowledge for storage infrastructure	3	85	75	L	M	-	-	-	-	-	-	M	-	-	H	-	-	-
CLO-6 :	Acquire the knowledge on structure of cloud computing and its techniques	3	80	70	M	-	-	-	-	-	-	-	L	-	-	H	-	-	-

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 SLO-2	*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)*

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 Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, 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

Course Code	19PCSE24T	Course Name	COMPUTATIONAL LOGIC	Course Category	E	Professional Elective	L	T	P	C
							3	0	0	3

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

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

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning 1: Level of Thinking (Bloom)	Learning 2: Expected Proficiency (%)	Learning 3: Expected Attainment (%)
CLO-1 :	Apply the skills acquired on propositional logic to solve examples at hand	2	80	85
CLO-2 :	Apply the rules learnt towards problem solving	2	75	80
CLO-3 :	Acquire mastry over FOL and Meta theorems and apply the same with confidence	2	85	80
CLO-4 :	Apply the acquired knowledge on AI under appropriate problem solving contexts	2	80	75
CLO-5 :	Attempt to apply the acquired knowledge on logics under appropriate problem solving contexts	2	75	85

Program Learning Outcomes (PLO)	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	13 PSO - 1	14 PSO - 2	15 PSO – 3
CLO-1 :	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	H	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	H	M	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	H	H	H	-	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	H	M	H	-	-	-	-	-	M	-	-	H	-	-	-

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 Logic:Problems	Semantics of FL: Illustration	Adequacy of FC to FL: Illustration	Adequacy of KC to K: Illustration
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 Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, 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	19PCSE25T	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	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understand the concept of authentication using biometrics.
CLR-2 :	Gain knowledge on the basics of biometric traits, sensors and data acquisition
CLR-3 :	Gain knowledge on design of biometric security systems
CLR-4 :	Acquire knowledge on pattern recognition systems
CLR-5 :	Introduce the various feature extraction and matching techniques for different biological traits.
CLR-6 :	Understand the real time application of biometrics

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning 1 LevelofThinking (Bloom)	2 ExpectedProficiency (%)	3 ExpectedAttainment(%)	Program Learning Outcomes (PLO) 1 EngineeringKnowledge	2 ProblemAnalysis	3 Design&Development	4 Analysis,Design, Research	5 ModernTool Usage	6 Society&Culture	7 Environment& Sustainability	8 Ethics	9 Individual & TeamWork	10 Communication	11 ProjectMgt.&Finance	12 LifeLongLearning	13 PSO-1	14 PSO-2	15 PSO– 3
CLO-1 :	Acquire the knowledge on various biometric traits	1	80	85	H	M	H	H	-	-	H-	-	-	-	-	-	-	-	-
CLO-2 :	Acquire the ability to identify pattern recognition system and its features	1	75	80	H	H	H	H	-	-	H	-	-	-	-	-	-	-	-
CLO-3 :	Understand the basic ideas about physical and behaviourial biometric traits	1	85	80	H	M	M	M	-	-	M	-	-	-	-	-	-	-	-
CLO-4 :	Apply the knowledge of biometrics on developing identification system.	2	80	75	H	M	M	M	-	H	-	H	-	-	-	-	-	-	-
CLO-5 :	Apply the knowledge for designing biometric sytems	2	75	85	H	H	L	-	-	-	-	-	-	-	-	-	-	-	-
CLO-6 :	Acquire the knowledge on authentication systems for real time security applications	1	80	85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Introduction of biometric systems	*Biometrics Sensors and Data Acquisition*	*Introduction to multibiometrics*	*Security of Biometric systems*	*Biometric Authentication Applications*
	SLO-2	Biometric functionalities: verification, identification	*Biometric data acquisition and database*	*Sources of multiple evidence*	*Adversary attacks*	*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*	*Insider attacks*	*immigration and naturalization*
	SLO-2	*Building blocks of a generic biometric system*	*The related biometrics preprocessing technologies*	*Processing sequence*	*Infrastructure attacks*	*welfare distribution*
S-3	SLO-1	Introduction to unimodal system	*Noise removing*	*Fusion level*	*Attacks at the user interface*	*military identification*
	SLO-2	Introduction to Multimodal biometric system	*Edge sharpening*	*Sensor level fusion*	*impersonation*	*banking, e.g., check cashing, credit card, ATM*
S-4	SLO-1	*Biometric system errors*	*Image restoration*	*Feature level*	*obfuscation*	*computer login; intruder detection; smart card*
	SLO-2	*Performance measures*	*Image segmentation*	*Score level*	*spoofing*	*multi-media communication; WWW and an electronic purse*
S-5	SLO-1	Image processing basics	*Pattern extraction and classification*	*Rank level*	*Attacks on biometric processing*	*sensor fusion; decision fusion*
	SLO-2	what is image, acquisition, type, point operations, Geometric transformations	*Pattern classification*	*Decision level*	*Attacks on system module and interconnections*	*categorization: e.g., age and gender*
S-6	SLO-1	First and second derivative	Fingerprint Recognition and acquisition	*Features Matching and Decision Making*	*Countermeasure:biometric template security*	*industrial automation*
	SLO-2	steps in edge detection, smoothening, enhancement, thresholding, localization,	*Fingerprint features, matching and synthesis*	*Feature matching: null and alternative hypothesis h0, h1, Error type I/II, Matching score distribution, FM/FNM, ROC curve, DET curve, FAR/FRR curve.*	*Countermeasure:spoof dectection*	*gesture interpretation;*
S-7	SLO-1	Robert's method, Sobel's method, Prewitt	*Face recognition and acquisition*	*Introduction to Various matching methods:*	Low level feature extraction	efficient enrollment
	SLO-2	Laplacian of Gaussian, Zero crossing	Face detection,feature extraction and matching	LDA	Describing image motion	audio-visual tracking

S-8	SLO-1	Biometric system authentication	*Iris recognition and acquisition*	*PCA, Eigen vectors and values, 2D-PCA, generalization to p-dim, covariance and correlation, algebra of PCA, projection of data*	High level feature extraction	stock market;
	SLO-2	physiological and behavioral properties of biometric system,	Iris Segmentation, normalization and matching		Template matching	on-line shopping
S-9	SLO-1	*Software biometrics systems*	Ear recognition and detection	*Introduce decision theory and their examples*	Hough transform for lines	compact embedded systems
	SLO-2	*Hardware biometrics systems*	Hand geometry and palmprint features	Explanation – examples	Hough transform for circles and ellipses	other commercialized services

Learning Resources	*1.James wayman,Anil k.Jain ,Arun A.Ross ,Karthik Nandakumar, ―Introduction to. Biometrics‖, Springer, 2011* *2. Mark S.Nixon, Alberto S.Aguado, Feature Extraction and image processing for computer vision, Third Edition, , Elsevier2012*	***3.****Digital Image Processing using MATLAB, By: Rafael C. Gonzalez, Richard Eugene Woods, 2nd Edition, Tata McGraw-Hill Education2010* ***4.****GuidetoBiometrics,By:RuudM.Bolle,SharathPankanti,NaliniK.Ratha,AndrewW.Senior,JonathanH. Connell, Springer2009* ***5.****PatternClassification,By:RichardO.Duda,DavidG.Stork,PeterE.Hart,Wiley2007* ***6.****ShimonK.Modi,―BiometricsinIdentityManagement:conceptstoapplications‖,ArtechHouse2011*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.*Raghuraghavendra* s,Chief Executive Officer at Forensic & Biometric Investigation Services FBIS Chennai, Tamil Nadu, India Chennai Area, India	Dr. J.Dhalia Sweetlin Designation:Assistant Professor [Sr Grade] Madras Institute of Technology, MIT Road, Radha Nagar, Chromepet, Chennai, Tamil Nadu 600044, India. Email:jdsweetlin@mitindia.edu Area of Specialisation:Image Processing, Soft Computing	*1. Dr. C. Malathy, SRMIST* *2.Ms.M.Gayathri,SRMIST* *3.Ms.Meenakshi,SRMIST*

Course Code	19PCSE31T	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	
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Analyze the fundamental of transmission and cellular systems
CLR-2 :	Apply skills in real time engineering problems and can have capability to evaluate the transmission errors
CLR-3 :	Comprehend the concept of mobile network, transport layer and wireless technologies
CLR-4 :	Differentiate the various types of cellular standard by their unique services.
CLR-5 :	Grasp GSM. GPRS, Handover and Localization techniques
CLR-6 :	Apply skills in various Routing protocols

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning 1 Level of Thinking (Bloom)	2 Expected Proficiency (%)	3 Expected Attainment (%)
CLO-1 :	Apply Wireless Technology concepts to Engineering problems related to communication	3	80	70
CLO-2 :	Improve their knowledge on Digital and analog Modulation techniques.	3	85	75
CLO-3 :	Equip themselves familiar with principle of Mobile Communication	3	75	70
CLO-4 :	Familiarize with Digital Cellular Standards	3	85	80
CLO-5 :	Acquaint with routing protocols	3	85	75
CLO-6 :	Expose to the emerging wireless technologies	3	80	70

Program Learning Outcomes (PLO)	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	13 PSO - 1	14 PSO - 2	15 PSO – 3
CLO-1 :	H	H	H	H	H	H	H	H	H	H	M	H	H	H	H
CLO-2 :	H	H	H	H	H	H	H	H	H	H	M	H	H	H	H
CLO-3 :	H	H	H	H	H	H	H	H	H	H	M	H	H	H	H
CLO-4 :	H	H	H	H	H	H	H	H	H	H	M	H	H	H	H
CLO-5 :	H	H	H	H	H	H	H	H	H	H	M	H	H	H	H
CLO-6 :	H	H	H	H	H	H	H	H	H	H	M	H	H	H	H

Duration (hour)		9	9	9	9	9
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

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*
	SL0-2	*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. *Gray J.Mullet "Wireless Telecommunication System and Networks", CENGAGE learning, reprint 2014.*
7. *Upena Dalal, "Wireless Communication" Oxford University Press, First edition 2009.*
8. *Kaveh Pahlavan & 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 Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr.Madan Lakshmanan	*Prof. Subra Ganesan*	*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	19PCSE32T	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 Learning Rationale (CLR):	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
CLR-6 :	

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 & TeamWork	Communication	Project Mgt.&Finance	Life Long Learning	PSO-1	PSO-2	PSO– 3
CLO-1 :	Acquire the knowledge on service oriented design technology	2	80	85	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	Acquire the ability to identify web services in SOA	2	75	80	H	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Understand the basic ideas about building SOA	2	85	80	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Appreciate the concepts of standards and security on SOA	2	80	75	H	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Apply the knowledge in Java based web servise	2	75	85	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-6 :	Acquire the knowledge on ASP .NET based web servises.	2	80	85	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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-OrientedArchitecture:Concepts,Technology,andDesign",PearsonEducation,2009.
2. EricNewcomer,Lomow,"UnderstandingSOAwithWebServices",PearsonEducation,2005
3. JamesMcGovern,SameerTyagi,MichaelEStevens,SunilMathew,"JavaWebServices Architecture",Elsevier,2003.

1. AchievingService-OrientedArchitecture:ApplyinganEnterpriseArchitectureApproach,RickSweeney,2010
2. 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% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts

Course Code	19PCSE33T	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:
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	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	Gain knowledge of the various standards	1	75	80	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Gain knowledge on the working of SNMP protocol and its various applications	1	85	80	H	-	-	-	M	-	-	-	M	-	-	-	-	-	-
CLO-4 :	To apply the network management tools and gather information from the network	2	75	70	H	-	-	-	M	-	-	-	M	-	-	-	-	-	-
CLO-5 :	To Familiarize with the working of various management applications	2	75	80	H	-	-	-	-	-	-	-		-	-	-	-	-	-
CLO-6 :	Apply the knowledge to create an efficient network	3	70	75	H	H	H	H	H	-	-	-	H	-	-	-	-	-	-

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	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, 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	19PCSE34T	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 Learning Rationale (CLR):	The purpose of learning this course is to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		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
CLR-1 :	Teach students the leading trends and systems in natural language processing.																		
CLR-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.																		
CLR-3 :	Teach them to recognize the significance of pragmatics for natural language understanding.																		
CLR-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.																		
CLR-5 :	To conceive basics of knowledge representation, inference, and relations to the artificial intelligence.																		
CLR-6 :	To understand natural language processing and to learn how to apply basic algorithms in this field																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Understand approaches to syntax and semantics in NLP.	2	80	85	H	H	H	H	H	-	-	-	H	M	M	H	H	H	H
CLO-2 :	Understand approaches to discourse, generation, dialogue and summarization within NLP.	2	75	80	H	H	H	H	H	-	-	-	H	M	M	H	H	H	H
CLO-3 :	Understand current methods for statistical approaches to machine translation.	2	85	80	H	L	M	H	H	-	-	-	H	M	M	H	H	H	H
CLO-4 :	Understand machine learning techniques used in NLP, including the probabilistic context-free grammars and unsupervised methods, as applied within NLP	2	80	75	H	H	H	H	H	-	-	-	H	M	M	H	H	H	H
CLO-5 :	Understand the knowledge of various levels of analysis involved in NLP	2	75	85	H	H	H	H	H	-	-	-	H	M	M	H	H	H	H
CLO-6 :	Gain knowledge in automated Natural Language Generation and Machine Translation	2	80	85	H	L	L	H	H	-	-	-	H	M	M	H	H	H	H

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)
	SLO-2				Interlingua	

Learning Resources	1. *DanielJurafskyandPrenticeHallJamesHMartin,"SpeechandLanguageProcessing:Anintroductionto NaturalLanguage Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2nd Edition,2018.* 2. *C.ManningandH.Schutze,"FoundationsofStatisticalNaturalLanguageProcessing",MIT Press. Cambridge,MA:,1999*	3. *JamesAllen,Bejamin/cummings,"NaturalLanguageUnderstanding",2ndedition,1995* 4. *YoavGoldberg,NeuralNetworkMethodsforNaturalLanguageProcessing.* 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	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, 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 (sent for review)*	*1. Dr. M.Ferni Ukrit, SRMIST*
		2. Dr.A.Pandian, SRMIST
		3.Ms.K.Meenakshi, SRMIST

Course Code	19PCSE35T	Course Name	APPLIED MACHINE LEARNING	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:*	**Learning**		
		1	2	3
		LevelofThinking (Bloom)	ExpectedProficiency (%)	ExpectedAttainment(%)
CLR-1 :	*Analyze the text data using Machine Learning*			
CLR-2 :	*Analyze the audio data using Machine Learning*			
CLR-3 :	*Analyze Time series and Sequential data using Machine Learning*			
CLR-4 :	*Analyze the Image Content using Machine Learning*			
CLR-5 :	*Visualize the data*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*			
CLO-1 :	*Identifying patterns in text using topic modeling*	*3*	*75*	*80*
CLO-2 :	*Building a speech recognizer*	*3*	*75*	*80*
CLO-3 :	*Extracting statistics from time series data, Building Conditional Random Fields for sequential text data*	*3*	*75*	*80*
CLO-4 :	*Building an object recognizer*	*3*	*75*	*80*

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
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
H	*M*	*H*	-	*H*	-	-	-	-	-	-	*H*	*H*	*H*	*H*
H	*M*	*H*	-	*H*	-	-	-	-	-	-	*H*	*H*	*H*	*H*
H	*M*	*H*	-	*H*	-	-	-	-	-	-	*H*	*H*	*H*	*H*
H	*M*	*H*	-	*H*	-	-	-	-	-	-	*H*	*H*	*H*	*H*

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Text Feature Engineering Introduction	Speech Recognition Introduction	Dissecting Time Series and Sequential Data	Image Content Analysis	Biometric Face Recognition
	SLO-2	Cleaning text data	Reading audio data	Introduction	Computer Vision	Face detection from the image and video
S-2	SLO-1	Preprocessing data using tokenization	Plotting audio data	Transforming data into the time series format Pandas and Numpy to convert Time Series data	Operating on images using OpenCV-Python	Capturing and processing video from a webcam Resizing and Scaling
	SLO-2	Tagging and categorising words	Transforming audio signals into the frequency domain	Plotting time series data	Learn to extract and load the image	Building a face detector using Haar cascades
S-3	SLO-1	Sequential tagging, Backoff tagging	Apply Fourier transform signal and plot	Slicing time series data Operating on time series data	Detecting edges Histogram equalization	determine the location of a face in the video frames captured from the webcam
	SLO-2	Creating features from text data-Stemming,	Generating audio signals with custom parameters	Plotting sliced time series data	Sobel filter, Laplacian edge detector, Canny edge detector	Face detector on the grayscale image
S-4	SLO-1	Lemmatising	Generate the time axis	Operating on time series data	Histogram equalization	Building eye and nose detectors
	SLO-2	Bagging using random forests	Synthesizing music	Extracting statistics from time series data	Visualize gray scale image	Face cascade classifier

S-5	SLO-1	Implementing bag of words	Construct the audio sample -amplitude and frequency	Correlation coefficients	Detecting corners	Visualize eye and nose detector
	SLO-2	Testing prepared data	synthesizer function	Plotting and understanding correlations	Understand the output corner detection image	Performing Principal Components Analysis
S-6	SLO-1	Analyze the results	Extracting frequency domain features	Building Hidden Markov Models for sequential data	Detecting SIFT feature points	PCA in face recognition systems
	SLO-2	Building a text classifier	MFCC and filter bank features	Prepare the Time Series data	SIFT feature detection	Convert the dataset from a five-dimensional set to a two-dimensional set
S-7	SLO-1	Analyzing the sentiment of a sentence	Building Hidden Markov Models	Train Gaussian HMM	Visualize the feature detected image	Kernel Principal Components Analysis
	SLO-2	Implement the sentiment analysis of a sentence	HMM training and prediction	Visualizing the model	Building a Star feature detector	Perform Kernel PCA
S-8	SLO-1	Identifying patterns in text using topic modeling	Building a speech recognizer	Building Conditional Random Fields for sequential text data	Detect features using the Star feature detector	Plot the PCA-transformed data
	SLO-2	Implement identifying patterns in text using topic modeling	MFCC features	CRF Model	Visualize keypoints on the input image	Plot Kernel PCA-transformed data
S-9	SLO-1	Case study- Twitter Data	Case study	Analyzing stock market data using Hidden Markov Models	Creating features using visual codebook and vector quantization	Performing blind source separation
	SLO-2	Case study- Twitter Data	Case study	Train the HMM and visualize	Method to quantize the data points	Independent Components Analysis

Learning Resources	1. *PrateekJoshiandco,Python:RealWorldMachineLearning,PacktPublishing,2016* 2. *SebastianRaschka,PythonMachineLearning,PacktPublishing,2013.*	3. *RichertCoelho,BuildingMachineLearningSystemswithPython,PacktPublishing,2016* 4. *MichaelBowles,MachineLearninginPython,Wiley&Sons,2015*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr.Harisekharan,CTO,Sri SeshaaTechnologies Pvt. Ltd., Chennai		1. Dr.G.Vadivu
Mr. S. Sudarsun - Director (R&D), Checktronix India Pvt.Ltd, Chennai		**2.** Mr.Karthik Nanmaran
		3. Dr.Renukadevi

Course Code	19PCSE36T	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 Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understand the fundamentals of Pattern Recognition techniques
CLR-2 :	Learn Statistical models of Pattern Recognition
CLR-3 :	Understand the principles of Clustering approaches to Pattern Recognition
CLR-4 :	Understand the Syntactic Pattern Recognition techniques
CLR-5 :	Understand the Neural Network approach to Pattern Recognition

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		LevelofThinking (Bloom)	ExpectedProficiency (%)	ExpectedAttainment(%)	EngineeringKnowledge	ProblemAnalysis	Design&Development	Analysis,Design, Research	ModernTool Usage	Society&Culture	Environment& Sustainability	Ethics	Individual & TeamWork	Communication	ProjectMgt.&Finance	LifeLongLearning	PSO-1	PSO-2	PSO– 3
CLO-1 :	Acquire the knowledge on the fundamentals of pattern recognition techniques	2	80	85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	Acquire the ability to apply Statistical models in Pattern Recognition	2	75	80	H	H	-	-	H	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Utilize the principles of Clustering techniques on various problems	2	85	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Acquire the ability to apply syntactic pattern recognition techniques	2	80	75	-	H	-	-	H	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Apply the knowledge gained on Neural pattern recognition methods	2	75	85	-	H	-	-	H	-	-	-	-	-	-	-	-	-	-
		2	80	85	-	H	-	-	H	-	-	-	-	-	-	-	-	-	-

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 (CYK) 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.,"PatternClassificationandSceneAnalysis",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	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
	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	19PCSE38T	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 Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Understand the fundamentals of Artificial Neural Networks*
CLR-2 :	*Learn the various topologies and learning algorithms of ANN*
CLR-3 :	*Understand the principles and fundamentals of Fuzzy Logic*
CLR-4 :	*Understand the Fuzzy Rule based systems*
CLR-5 :	*Understand the basic concepts and techniques of Genetic Algorithms*
CLR-6 :	*Utilize the Neural, Fuzzy and Genetic Algorithms for real-time application development*

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 on constructing a neural network*	*3*	*80*	*75*
CLO-2 :	*Identify the basic Neural net and learning algorithm to apply for a real time problem*	*3*	*85*	*75*
CLO-3 :	*Acquire the ability to use Fuzzy operators, membership functions, Fuzzification and Defuzzification Techniques*	*3*	*75*	*70*
CLO-4 :	*Gain Knowledge on applying the Fuzzy rules to different applications*	*3*	*85*	*80*
CLO-5 :	*Acquire the knowledge of fitness functions and Genetic operators*	*3*	*85*	*75*
CLO-6 :	*Apply the Genetic Algorithm to real-time applications*	*3*	*80*	*70*

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
L	*H*	-	*H*	*L*	-	-	-	*L*	*L*	-	*H*	-	-	-
M	*H*	*M*	*M*	*H*	-	-	-	*M*	*L*	-	*H*	-	-	-
M	*H*	*M*	*H*	*M*	-	-	-	*M*	*L*	-	*H*	-	-	-
M	*H*	*M*	*H*	*H*	-	-	-	*M*	*L*	-	*H*	-	-	-
H	*H*	*M*	*H*	*M*	-	-	-	*M*	*L*	-	*H*	-	-	-
M	*H*	*M*	*H*	*H*	-	-	-	*L*	*L*	-	*H*	-	-	-

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	Crisp Relations, Fuzzy relations, Properties, operations,	Fuzzification	Classification of Genetic Algorithm
	SLO-2		Competitive networks: Maxnet			
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 system- Adaptive Neuro-Fuzzy Inference Systems Coactive Neuro-Fuzzy Modeling	Application of Genetic Algorithm
	SLO-2		Practice of Neural Network tool : Pattern Classification	Practice of Fuzzy Logic tool: Fuzzy functions	Recent Applications	Practice of Optimization and Genetic algorithm tool

S-9	SLO-1	Practice of Neural Network tool : XOR problem	Practice of Neural Network tool : Pattern Clustering	Practice of Fuzzy Logic tool: Fuzzy operations	Practice of Fuzzy Logic tool : Fuzzy controller design and applications	
	SLO-2					

Learning Resources	1. Samir Roy, Udit Chakraborty, "Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms", 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 Applications", Pearson Education, 2008. 4. Timothy J. Ross , "Fuzzy Logic with Engineering Applications", John Wiley & Sons Ltd, 2010. 5. David E. Goldberg, "Genetic Algorithms-In Search, optimization and Machine Learning", 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	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, 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, Vellore*	*2. Dr. D. Malathi, SRM IST*
		3. Dr. Ferni Ukrit, SRM IST

Course Code	19PCSE39T	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 Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understand how addressing and routing are tied together and different architectural components are related to routing.
CLR-2 :	Gain knowledge on the need for routers, its functionality and different architectures.
CLR-3 :	Understand fundamental basis of various algorithms in centralized and distributed point of view.
CLR-4 :	Apply the knowledge of IP addressing in various routing algorithms.
CLR-5 :	Understand the various types of key routing protocols used in wireless networks.
CLR-6 :	Gain knowledge on past experiences and prepare for next generation networks and routing

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		LevelofThinking (Bloom)	ExpectedProficiency (%)	Expected Attainment(%)	EngineeringKnowledge	ProblemAnalysis	Design&Development	Analysis,Design, Research	ModernTool Usage	Society&Culture	Environment& Sustainability	Ethics	Individual & TeamWork	Communication	ProjectMgt.&Finance	LifeLongLearning	PSO-1	PSO-2	PSO– 3
CLO-1 :	Acquire the knowledge of how data transfer happens in conventional networks	2	80	85	H	M	-	-	L	-	-	-	-	M	-	H		-	-
CLO-2 :	Comprehend Router Architectures and IP Address Lookup Algorithms	2	75	80	H	H	M	M	L	-	-	-	-	-	L	H	-	-	-
CLO-3 :	Compare routing techniques and protocols	2	85	80	H	H	L	M	M	-	-	-	M	-	L	H	-	-	-
CLO-4 :	Examine how different dimensions of routing differ for different types of network	2	80	75	H	H	H	H	H	L	-	M	M	-	-	H	-	-	-
CLO-5 :	Apply various routing algorithms in wireless network scenario.	2	75	85	H	H	H	H	M	-	-	-	M	-	-	H	-	-	-
CLO-6 :	Understand various routing paradigms in next generation	2	80	85	H	H	H	M-	M	L	-	-	-	-	-	H	-	-	-

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	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	Routing Table, Communication of Routing Information	Classifications of routing protocols
S-2	SLO-1	IP addressing- Classful 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	Classless Addressing	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 – OSI Reference Model	Packet Flow	Shortest Path Computation with Candidate Path Caching	Interior Gateway Routing Protocol (IGRP)	On-Demand Routing Protocols: Dynamic Source Routing Protocol
	SLO-2	IP Protocol Stack Architecture	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 SLO-2					*PSTN Call Routing Using the Interne*

Learning Resources	1. *D.Medhi and K.Ramasamy, Network Routing : Algorithms, Protocols and Architectures, MorganKaufmann Publishers, First Edition2007.* 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 Edition2017.*	4. *SteenStrubM,RoutinginCommunicationnetworks,PrenticeHallInternational,1995.* 5. *InternetworkingTechnologiesHandbook,Inc.CiscoSystems,ILSGCisco*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, 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. S.Anbuchelian, Anna University. anbuchelian@annauniv.edu*	1. *Dr.FemildaJosephin J S,SRMIST*
		2. *Mr.RajeshBabu,SRMIST*
		3. *Mr. J.Godwin,SRMIST*

Course Code	19PCSE40T	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 Learning Rationale (CLR):	The purpose of learning this course is to:
LR-1 :	Describe the importance of various Internet protocols like ARP, RARP, ICMP, Multicasting and multi routing, SCTP
CLR-2 :	Understand the transport layer protocols , application layer protocol and its characteristics
CLR-3 :	Learn and Understand IPV6 technologies
CLR-4 :	Work with client server sockets and develop related applications to communicate with each other.
CLR-5 :	Understand the wide area network protocols
CLR-6 :	Learn the basics of MPLS protocol

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		LevelofThinking	ExpectedProficie	ExpectedAttainm	Engineering	ProblemAnalysis	Design&Develop	Analysis,Design, Research	ModernTool	Society&Culture	Environment& Sustainability	Ethics	Individual &	Communication	ProjectMgt.&Fina	LifeLongLearning	PSO-1	PSO-2	PSO– 3
CLO-1 :	Identify the basics of different types of network and transport layer protocols	2	80	85	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	Design and implement the socket programming	2	75	80	H	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Enumerate the types of application layer protocols	2	85	80	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Analyze and compare the IPv4 and IPv6 protocols	2	80	75	H	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Familiarize with wide area technologies	2	75	85	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-6 :	Describe the working of MPLS protocol	2	80	85	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, 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	19PCSE41T	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:	Learning
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	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Understand the basic ideas about sensor network concepts with Applications and Apply the knowledge for WSN tools	2	80	85
CLO-2 :	Acquire the knowledge on wireless transmission technology ,hardware and Medium Access Protocols	2	75	80
CLO-3 :	Understand the basic ideas about Wireless Sensor Networks Routing protocols and network - transport layer characteristics	2	85	80
CLO-4 :	Apply the knowledge for network management and Middleware services	2	80	75

Program Learning Outcomes (PLO)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	H	H	H	H	M	M	M	M	M	H	L	H	H	H	H
CLO-2 :	H	H	H	H	M	M	M	M	M	H	L	H	H	H	H
CLO-3 :	H	H	H	H	M	M	M	M	M	H	L	H	H	H	H
CLO-4 :	H	H	H	H	M	M	M	M	M	H	L	H	H	H	H

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	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		1. Dr**. Revathi Venkatraman**, SRMIST ***2.** Dr.N.Snehalatha, **SRMIST*** ***3. Dr.MB.Mukesh krishnan, SRMIST***

Course Code	19PCSE42T	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:
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			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	ModernToolUsage	Society&Culture	Environment& Sustainability	Ethics	Individual & TeamWork	Communication	ProjectMgt.&Finance	LifeLongLearning	PSO-1	PSO-2	PSO– 3
CLO-1 :	Acquire the knowledge of Modern processors and concepts	2	80	85	H	H		-	-			-	-	H	-	-	-	-	-
CLO-2 :	Understand the basic ideas about Optimizations	2	75	80	-	H	-	-	-	-	-	-	-	-	-	-	-	-	H
CLO-3 :	Acquire the ability to identify parallel computers	2	85	80	-	-	H	-	-	-	-	M	-	-	L	-	-	-	-
CLO-4 :	Appreciate the concepts of parallelization	2	80	75	-	H	-	-	H	-	-	-	H	-	-	H		-	-
CLO-5 :	Apply the knowledge on parallel programming using Open MP	2	75	85	-	-	-	H	-	L	L	-	-	-	-	-	-	-	-
CLO-6 :	Acquire the knowledge on parallel programming using MPI	2	80	85	-	-	-	-	-	-	-	-	-	-	-	-	H	H	-

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
	SLO-1	Maximum performance estimates	Loop kernels and iterators	Choosing the right scaling baseline	False sharing	Nonblocking vs. asynchronous communication,

S-9	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	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		1. J. Godwin Ponsam, SRMIST
		2. Mr.SivakumarSRMIST

Course Code	19PCSE43T	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 Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understand the fundamentals of security relates to information
CLR-2 :	how security is maintained in information systems
CLR-3 :	Understand the concept of security models in database
CLR-4 :	Implementation of virtual private database
CLR-5 :	Learn the procedures of database auditing
CLR-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	2	3
		LevelofThinking (Bloom)	ExpectedProficiency (%)	ExpectedAttainment(%)
CLO-1 :	Acquire the knowledge of information system and information security	2	80	85
CLO-2 :	Able to manage the security of information system as well as database	2	75	80
CLO-3 :	Able to design and develop the security model in database	2	85	80
CLO-4 :	Able to implement VPD in various database	2	80	75
CLO-5 :	Able to audit the database activities, users, security	2	75	85
CLO-6 :	Apply the security mechanism in PPDM using various algorithms	2	80	85

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

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*	*1. 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	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.SomuChockalingam, Founder and President,Doyensys,Chennai	*Dr.K.Vivekanandan,Professor,Pondicherry Engineering College*	*1. Dr.B.Murugananthan,SRMIST*
		2.. Ms.Thenmozhi,SRMIST
		3.. M.Maheswari,SRMIST

Course Code	19PCSE44T	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 Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understand the concepts of Data Mining
CLR-2 :	Familiarize with Association rule mining
CLR-3 :	Familiarize with various Classification algortihms
CLR-4 :	Understand the concepts of Cluster Analysis
CLR-5 :	Familiarize with Outlier analysis techniques
CLR-6 :	Familiarize with applications of Data mining in different domains

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning 1 Level of Thinking (Bloom)	2 Expected Proficiency (%)	3 Expected Attainment (%)	Program Learning Outcomes (PLO) 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	13 PSO - 1	14 PSO - 2	15 PSO – 3
CLO-1 :	Gain knowledge about the concepts of Data Mining	2	80	85															
CLO-2 :	Understand and Apply Association rule mining techniques	2	75	80															
CLO-3 :	Understand and Apply various Classification algortihms	2	85	80															
CLO-4 :	Gain knowledge on the concepts of Cluster Analysis	2	80	75															
CLO-5 :	Gain knowledge on Outlier analysis techniques	2	75	85															
CLO-6 :	Understand the importance of applying Data mining concepts in different domains	2	80	85															

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, Morgan Kauffman Publishers, 2011.* 2.	3. 4.

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.V.Selvakumar, Hexaware Technologies, selvakumarv@hexaware.com	***1. Dr.Latha Parthiba, Pondicherry University, lathaparthiban@yahoo.com***	***1. Mr.L.N.B.Srinivas, SRMIST***
2.	**2.**	***2. Mr.S.Karthick, SRMIST***
		3. Dr.V.V.Ramalingam, SRMIST

Course Code	19PCSE45T	Course Name	PRINCIPLES OF CLOUD 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 and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
CLR-1 :	Understand the fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	Learn cloud enabling technologies and get exposure to advanced clouds			
CLR-3 :	Explore cloud storage technologies and relevant distributed file systems, NoSQL databases and object storage;			
CLR-4 :	Understand the cloud security threats and protective mechanism for cloud computing			
CLR-5 :	Participate in team-based peer reviews to analyze the security development life cycle and mitigate risks and vulnerabilities			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	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 :	Explain terms used in secured software development and life cycle process	3	80	70	H	H	H	H	H	-	-	-	L	L	-	H	-	-	-
CLO-2 :	Apply fundamental concepts in cloud infrastructures to understand the cloud system, network and virtualization and outline their role in enabling the cloud computing system model.	3	85	75	M	H	L	M	H	M	-	-	M	L	-	H	-	-	-
CLO-3 :	Illustrate the fundamental concepts of cloud storage and demonstrate their use in storage systems such as Amazon S3 and HDFS	3	75	70	M	H	M	M	H	-	-	-	M	L	-	H	-	-	-
CLO-4 :	Evaluate the security issues related to cloud computing and handle the security threats and construct different cloud delivery design models.	3	85	80	M	H	L	H	M	-	-	-	M	L	-	H	-	-	-
CLO-5 :	Analyze various cloud programming models and apply them to solve problems on the cloud.	3	85	75	H	H	M	H	H	M	-	-	M	M	-	H	-	-	-

Duration (hour)		9	9	9	9	9
S-1	**SLO-1**	Introduction to Cloud Computing	Cloud enabling technologies-Broadband networks and Internet architecture	Introduction to Cloud Data Storage, The evaluation of storage technology	Fundamental Cloud Security	Cloud Application Development and Architectural Styles
	SLO-2	Evolution of cloud computing			Basic Terms and Concepts	
S-2	**SLO-1**	Network-Centric Computing	Data Center Technology	Storage Models	Threat Agents, Cloud Security Threats	MapReduce Programming Model
	SLO-2	Network-Centric Content				
S-3	**SLO-1**	Origin of Cloud Computing, Basic Concepts and Terminology	Web Technology	File Systems and databases	Cloud Security Mechanisms	Case Study: the GrepTheWeb Application
	SLO-2		Multitenant Technology			
S-4	**SLO-1**	Goals and Benefits	Service Technology Virtualization Technology	Distributed File Systems Google File System	Encryption Hashing	Hadoop: Yarn and Tez
	SLO-2	Risks and Challenges, Roles and Boundaries, Cloud Characteristics				
S-5	**SLO-1**	Cloud Service Models	Virtual Machines	HDFS	Digital Signature, Public Key Infrastructure	SQL on Hadoop: Pig, Hive, and Impala
	SLO-2	Cloud Deployment Models		NoSQL Databases		
S-6	**SLO-1**	Cloud Service Providers and the Cloud Ecosystem	Full Virtualization and Para-virtualization	Cloud Databases (HBase, MongoDB, Cassandra, DynamoDB)	Identity and Access Management, Single Sign-On: Kerberos authentication	Current Cloud Applications and New Opportunities
	SLO-2					
S-7	SLO-1	Amazon Web Services(AWS), Google Clouds,	Hardware Support for Virtualization	Cloud Object Storage (Amazon S3, OpenStack Swift, Ceph)	One-time password, Basic cloud data security mechanisms	Design approaches with Case Study
	SLO-2	Microsoft Azure Cloud				
S-8	SLO-1	SLA Management in Cloud Computing: A Service Providers Perspective	Kernel-Based Virtual Machine, Hypervisors	Data Storage for Online Transaction Processing Systems	Virtual Machine Security, Security of Virtualization, A Trusted Hypervisor	Design methodology for IaaS Service Model
	SLO-2					
S-9	SLO-1	Case Study on Open Source & Commercial	Containers; Docker Containers, Kubernetes	Disk Locality versus Data Locality in Computer Clouds	Mobile Devices and Cloud Security	Google API, AWS EC2 Instances.
	SLO-2	Clouds: Eucalyptus, OpenStack, Aneka				

Learning Resources	1.**Dan C. Marinescu**," Cloud Computing Theory and Practice", Second Edition Copyright © **2018** Elsevier Inc. All.https://www.sciencedirect.com/book/9780128128107/cloud-computing 2.Rajkumar Buyya, James Broberg, AndrzejGoscinski, Cloud Computing Principles and Paradigms, Wiley Publications, 2017. 3. Thomas Erl, ZaighamMahmood, and RichardoPuttini, "Cloud Computing: Concepts, Technology & Architecture", Prentice Hall/PearsonPTR, Fourth Printing, 2014, ISBN: 978013338752.	4.K. Chandrasekaran, "Essentials of Cloud Computing", Chapman and Hall/CRC Press, 2014, ISBN 9781482205435 5.Arshdeep Bahga, Vijay Madisetti, "Cloud Computing: A Hands-On Approach", University Press, 2016, ISBN-13: 978-0996025508.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
SuriyadeepanRamamoorthy Research Engineer at Saama Technology Puducherry, Puducherry, India Information Technology and Services	Dr.E. Ilavarasan Professor,CSE Pondicherry Engineering college.	1.Mrs Krishnaveni,SRMIST,KTR-SWE
		2.Dr.S.Ramamooorthy,SRMIST,KTR-CSE
		3.Mr.K. Venkatesh,SRMIST,KTR-IT
		4.Mr. S.VidhyaSagar,SRMIST,Vadapalani campus

Course Code	19PCSP42L	Course Name	MAJOR PROJECT	Course Category	P	*Project Work, Seminar*	L	T	P	C
							0	0	30	15

Pre-requisite Courses	*Nil*	Co-requisite Courses	Nil	Progressive Courses	*Nil*
Course Offering Department	*CSE*	**Data Book / Codes/Standards**		*As required for the project work*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*To prepare the student to gain major design and or research experience as applicable to the profession*
CLR-2 :	*Apply knowledge and skills acquired through earlier course work in the chosen project*
CLR-3 :	*Make conversant with the codes, standards , application software and equipment*
CLR-4 :	*Carry out the projects within multiple design constraints*
CLR-5 :	*Incorporate multidisciplinary components*
CLR-6:	*Acquire the skills of comprehensive report writing*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*
CLO-1 :	*Design a system / process or gain research insight into a defined problem as would be encountered in engineering practice taking into consideration its impacton global, economic, environmental and social context.*

Learning Assessment					
Continuous Learning Assessment	Assessment tool	Review I	Review II	Review III	Total
	Weightage	5%	20%	25%	50%
Final Evaluation	Assessment tool	Project Report	Viva Voce *		Total
	Weightage	20%	30%		50%

Course Code	19PCSO11T	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& Engg.	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understand the design factors and challenges in IT Infrastructure Management
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 commerce.

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		LevelofThinking (Bloom)	ExpectedProficiency (%)	ExpectedAttainment(%)	EngineeringKnowledge	ProblemAnalysis	Design&Development	Analysis,Design, Research	ModernTool Usage	Society&Culture	Environment& Sustainability	Ethics	Individual & TeamWork	Communication	ProjectMgt.&Finance	LifeLongLearning	PSO-1	PSO-2	PSO– 3
CLO-1 :	Be able to describe the business value and processes of ICT services in an organization and apply that knowledge and skill with initiative to a workplace scenario	2	80	85	L	-	L	H	L	-	-	-	H	H	M	L	-	-	-
CLO-2 :	Be able to investigate, critically analyze and evaluate the impact of new and current ICT services to an organization	2	75	80	M	-	-	H	H	-	-	-	L	L	L	H	-	-	-
CLO-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	2	85	80	M	L	M	H	L	-	-	-	M	H	H	H	-	-	-
CLO-4 :	Be able to demonstrate the technical and communications skills that contribute to the operation of ICT services in an organization	2	80	75	M	L	L	L	-	-	-	-	H	H	M	L	-	-	-
CLO-5 :	Be able to reflect critically on the role of an enterprise architect in an organization	2	75	85	L	-	L	L	-	-	-	-	L	L	H	L	-	-	-
CLO-6 :	Be able to synthesize the theoretical, technical and management issues that deliver ICT services to an organization	2	80	85	H	-	L	L	L	-	-	-	L	L	H	L	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Introduction – IT Infrastructure Challenges in IT Infrastructure Management	Service Delivery And Support Process - Intro	Storage And Security Management - Intro Backup and Storage, Archive & Retrieve	Performance And Tuning Process	Case Studies
	SLO-2					
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 Infrastructure 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	IT Systems and Service Management Process	Service desk, Incident management	Computer Security Identity Management	Assessing an Infrastructure's performance and tuning process	Tycocase
	SLO-2					

S-8	SLO-1	*Information systems Design Process*	*Availability management,*	*Access control system*	*Measuring and streamlining the P and T process*	*Worldcom case*
	SLO-2					
S-9	SLO-1	*IT Infrastructure Library*	*Release Management*	*Intrusion Detection*	*Performance tuning recommendations for data and event management*	*Analyze an information infrastructure – case study*
	SLO-2					

Learning Resources	1. *Rich Schiesser, " IT Systems Management", 2nd edition, 2010, Pearson Education, ISBN: 978-0137025060* 2. *P.Gupta,"ITInfrastructureandItsManagement"2ndReprint,2010,TataMcGrawHill,ISBN: 978-0070699793* 3. *SjaakLaan,"ITInfrastructureArchitecture:InfrastructureBuildingBlocksandConcepts",2011, Lulu Press Inc, ISBN978-1-4478-8128-5.*	4. *LeonardJessup,JosephValacich,"InformationSystemToday:ManagingDigitalWorld",3rdEdition, 2007, Prentice Hall, ISBN:0-13-233506-9.* 5. *Hausman,Cook,"ITArchitectureforDummies",2011,WileyPublishing,Hoboken,NJ www.wiley.com ISBN:978-0-470-55423-4* 6. *RichardJ.Reese,"ITArchitectureinAction",2008,XlibrisPublishing,ISBN:978-1-4363-0505-1*

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 Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, 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,Chennai. 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. MB.Mukesh Krishnan, SRMIST*

Course Code	19PCSO12T	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 Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understand the basics of Android devices andPlatform.
CLR-2 :	Acquire knowledge on basic building blocks ofAndroid programming required for Appdevelopment.
CLR-3 :	Understand persistence Data storage mechanismin Android
CLR-4 :	Understand advanced application concepts likenetworking, Animations and Google Maps services etc.
CLR-5 :	Develop and publish Android applications in toAndroid Market
CLR-6 :	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning		
		1	2	3
		LevelofThinking (Bloom)	ExpectedProficiency (%)	ExpectedAttainment(%)
CLO-1 :	Acquire the knowledge on Android devices and Platform	2	80	85
CLO-2 :	Acquire knowledge on basic building blocks ofAndroid programming required for Appdevelopment.	2	75	80
CLO-3 :	Apply the knowledge of persistence Data storage mechanismin Android	2	85	80
CLO-4 :	Apply the knowledge in advanced application concepts likenetworking, Animations and Google Maps services etc.	2	80	75
CLO-5 :	Design and apply the knowledge to publish Android applications in toAndroid Market	2	75	85
		2	80	85

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

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 Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, 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	19PCSO13T	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 Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning			Program Learning Outcomes (PLO)															
CLR-1 :	*Select a suitable modeling method according to problem area and assignment, and justify their choice.*	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	*Formulate models of a system to describe the system on different levels of abstraction and from different viewpoints.*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-3 :	*Learn and apply the continuous system simulation*																		
CLR-4 :	*Learn theory and probability concepts in simulation*																		
CLR-5 :	*Learn the simulation languages and tools*																		
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*																		
CLO-1 :	*Implement the appropriate modeling method for the given problem*	*2*	*80*	*85*	*H*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	*Explain the system abstraction in different levels*	*2*	*75*	*80*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	*Apply the models under continuous system simulation*	*2*	*85*	*80*	*H*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	*Analyze the probability concepts for simulating a system*	*2*	*80*	*75*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	*Apply tools to like GPSS and SIMSCRIPT to check model properties of a system*	*2*	*75*	*85*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-

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	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, 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	19PCSO14T	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 Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	Be exposed to the context and operation of free and open source software (FOSS) communities and associated software projects.
CLR-2 :	Be familiar with participating in a FOSS project
CLR-3 :	Learn scripting language like Python or Perl, Ruby
CLR-4 :	Learn some important FOSS tools and techniques

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning		
		1	2	3
		LevelofThin	ExpectedPr	ExpectedAtt
CLO-1 :	Install and run open-source operating systems.	*3*	*80*	*70*
CLO-2 :	Gather information about Free and Open Source Software projects from software releases and from sites on the internet.	*3*	*85*	*75*
CLO-3 :	Build and modify one or more Free and Open Source Software packages.	*3*	*75*	*70*
CLO-4 :	Contribute software to and interact with Free and Open Source Software development projects.	*3*	*85*	*80*
CLO-5 :	Identify and apply various linux commands	*3*	*85*	*75*

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

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Introduction-	Linux Installation and Hardware Configuration	Unix file system, Unix files, i-nodes and structure and file system relatedcommands	Usage of design Tools like Argo UML or equivalent	Open Source Software Development
	SLO-2	Open Source, Free Software, Free Software vs. Open Source software				
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 SLO-2	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,

S-7	SLO-1 SLO-1	Four degrees of freedom	X Windows System Configuration	Shell scripting for system configurations	conditional statements, classes, Exceptions packages	Open Office
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 SLO-2	Implications	Strategies for keeping a Secure Server	Shell scripting with looping		

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	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40 %*		*30 %*		*30 %*		*30 %*		*30 %*	
Level 2	Apply Analyze	*40 %*		*40 %*		*40 %*		*40 %*		*40 %*	
Level 3	Evaluate Create	*20 %*		*30 %*		*30 %*		*30 %*		*30 %*	
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.Bijoymon Soman *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	19PCSO15T	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 Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understand the basics of Android devices and Platform.
CLR-2 :	Acquire knowledge on basic building blocks of Android programming required for Application development
CLR-3 :	Gain knowledge to user interfaces used in android applications
CLR-4 :	Acquire knowledge on advanced application concepts like networking, Animations and Google Maps services etc
CLR-5 :	Develop and publish Android applications in to Android Market
CLR-6 :	Understand the knowledge of JSON and MQTT

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		LevelofThinking (Bloom)	ExpectedProficiency (%)	ExpectedAttainment(%)	EngineeringKnowledge	ProblemAnalysis	Design& Development	Analysis,Design, Research	ModernTool Usage	Society&Culture	Environment& Sustainability	Ethics	Individual & TeamWork	Communication	ProjectMgt.&Finance	LifeLongLearning	PSO-1	PSO-2	PSO– 3
CLO-1 :	To exposed to technology and business trends impacting Android Platform	2	80	85	H	-	L	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	Be competent with the characterization and architecture of mobile applications	2	75	80	L	H	H	-	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	To understanding enterprise scale requirements of mobile applications	2	85	80	H	-	H	L	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	To designing and developing mobile applications using one application development framework	2	80	75	L	L	H	-	-	-	-	-	-	-	M	-	-	-	-
CLO-5 :	To understand how to handle and share android data	2	75	85	L	-	H	H	L	-	-	-	-	-	-	-	-	-	-
CLO-6 :	To develop an android services and to publish android application for use	2	80	85	H	-	H	-	-	-	-	-	-	-	M-	-	-	-	-

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. *BillPhillipsandBrianHardy,AndroidProgramming:TheBigNerdRanchGuide,BigNerdRanch,Inc. 2013*	3. *MarkWickham,PracticalAndroid:14CompleteProjectsonAdvancedTechniquesandApproaches, Apress,2018* 4. *DavidGriffiths,HeadFirst:AndroidDevelopment,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	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. *DineshBabuT,DevelopmentManager,HPIndia.dinesh.thavamani@hp.com*		1. *Mr.S.Pradeep,SRMIST*
2. *SurajSundaram,AssociateITConsultant,TCSCanada.suraj.s@tcs.com*		2. *Mr. C. Arun,SRMIST*

Course Code	19PCSO16T	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 Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understand and write programs in R
CLR-2 :	Gain knowledge on the working of statistical data in R
CLR-3 :	Gain knowledge on Linear regression and manipulation in R
CLR-4 :	Acquire knowledge on classification and clustering in R
CLR-5 :	Acquire knowledge on Linear Model selection and regulaization and working it in R
CLR-6 :	Introduce the Tree baed methods and working it in R

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		LevelofThinking (Bloom)	ExpectedProficiency (%)	ExpectedAttainment(%)	EngineeringKnowledge	ProblemAnalysis	Design&Development	Analysis,Design, Research	ModernTool Usage	Society&Culture	Environment& Sustainability	Ethics	Individual & TeamWork	Communication	ProjectMgt.&Finance	LifeLongLearning	PSO-1	PSO-2	PSO– 3
CLO-1 :	Acquire the knowledge on data analysis in R	2	80	85	H	-	-	-	H	-	-	-	-	-	-	-	-	-	-
CLO-2 :	Acquire the ability to find meaning pattern using R	2	75	80	H	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Acquire the ability to find graphically interpret data in R	2	75	80	H	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Apply the knowledge for implementing anlaytical alogirthms	2	80	75	H		-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Handle large scale analytics projects from various domains	2	75	85	H	H	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-6 :	Develop intelligent decision support systems	2	75	80	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-

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 Coefficient Estimates	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 - Estimating the 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 for p = 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 Methods Ridge Regression	Principal Components Analysis - What Are Principal Components?
	SLO-2	Matrix operations, Visualizing with Matplot()	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*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, etc.,

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. Prakash V, ***Technical Lead at Bridgeline Digital Inc*** ***Greater Boston Area***				**2.Dr.Latha Karthigaa, PhD,** **Innovation Research Assistant,** **The University of Auckland**		***2. Dr.Alice Nithya, SRMIST***

Course Code	19PCSO17T	Course Name	IOS 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	CSE	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
		LevelofThinking (Bloom)	ExpectedProficiency (%)	ExpectedAttainment(%)
CLR-1 :	Understand the basics of ios device and platform			
CLR-2 :	Understand the basic building blocks of ios programming required for App development			
CLR-3 :	Understand Data storage mechanism in ios			
CLR-4 :	Understand advanced application concepts like animations, webservices,etc			
CLR-5 :	Develop and publish ios application in to ios market			
CLR-6 :	understanding enterprise scale requirements of mobile application			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		LevelofThinking (Bloom)	ExpectedProficiency (%)	ExpectedAttainment(%)	EngineeringKnowledge	ProblemAnalysis	Design&Development	Analysis,Design, Research	ModernTool Usage	Society&Culture	Environment& Sustainability	Ethics	Individual & TeamWork	Communication	ProjectMgt.&Finance	LifeLongLearning	PSO-1	PSO-2	PSO– 3
CLO-1 :	Acquire the knowledge of ios device and platform	2	80	85	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	Acquire the knowledge on ios programming for App Development	2	75	80	H	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Apply the concepts used for data storage in ios	2	85	80	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Apply the animation and webservice concepts in the App	2	80	75	H	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Understand the basic idea to publish ios application into ios market	2	75	85	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-6 :	Understand the needs of enterprise to develop App	2	80	85	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Top Mobile OS in Market	The Swift Language-Types	Programmatic views-anchors,Margins	Stack Views	Webservices
	SLO-2	Difference between IOS and Android	Literals and subscripting, Initializers, Properties, Instance methods	Programmatic controls	Nested stack views	
S-2	SLO-1	IOS Architecture	Optionals,Subscripting dictionaries, Loops and String Interpolation	Localization	Segues	JSON Data
	SLO-2		Enumerations			
S-3	SLO-1	History of IOS	Views-Basics	Internalization	UINavigation Controller	Collection views
	SLO-2		Frames, Customizing the labels		Dismissing the keyboard	
S-4	SLO-1	Requirements	The auto Layout System	Controlling Animations	Even handling basics	Extensions
	SLO-2		Adding Constraints	Completion,constraints		
S-5	SLO-1	Versions	Text Input- Editing,Keyboard attributes	Timing functions	Camera	Image caching
	SLO-2					
S-6	SLO-1	Framework -MVC Design Pattern	Dismissing the keyboard	Debugging	Saving,Loading and Application States	Core Data
	SLO-2		Number formatters			
S-7	SLO-1	Application Life Cycle	Delegation	UITableView and Controller	Loading files, Error handling	Fetch requests and predicates
	SLO-2		Conforming to a protocol			
S-8	SLO-1	Features	View controllers	Editing UITableview	Size class	Core Data Relationships
	SLO-2		UITabBarController			
S-9	SLO-1	A simple IOS Application	Appearing and accessing views	Subclassing UITableViewcell	Touch Events and UIResponder	Accessibility
	SLO-2					

Learning Resources	1. *ChristianKeur,AaronHillegass,iosprogramming:TheBigNerdRanchGuide,6th ed.,Pearson,2016.* 2. *Jon Hoffman, Mastering Swift,4th ed.,Packt Publishing Ltd.,2017.*	3. *Fahim Farook, Matthijs Hollemans, ios Apprentice,7th ed.,Razeware LLC,2018.* 4. *Michael Grant, ios Navigation101,2019.*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Surprise Test, Seminars, etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.K.Mahendran, Founder, Dreams Technologies, Chennai.	*1.*	*1. Dr.D.Rajeswari, SRMIST*
2.	*2.*	*2. Mr.K.Navin, SRMIST*