15.B.Tech.in Computer Science and Engineering

16. (a) Mission of the Department

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

16. (b) Program Educational Objectives (PEO)

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

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

	Mission Stmt. – 1	Mission Stmt. – 2	Mission Stmt. – 3	Mission Stmt. – 4	Mission Stmt. – 5
PEO – 1	*3*				*1*
PEO – 2			*2*		
PEO – 3		*3*	*3*		
PEO – 4				*2*	*3*
PEO – 5				*3*	

3 – High Correlation, 2 – Medium Correlation, 1 – Low Correlation

16. (d) Mapping Program Educational Objectives (PEO) to Program Outcomes (PO)

	Program Outcomes (PO)											
	Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and society	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning
PEO – 1	*3*			*1*		*2*		*3*	*2*	*3*		
PEO – 2		*2*	*2*		*3*		*3*	*2*				
PEO – 3		*3*	*3*	*2*						*2*		*3*
PEO – 4		*2*	*3*			*3*	*2*		*2*		*2*	*2*
PEO – 5						*3*			*3*	*3*	*3*	*3*

3 – High Correlation, 2 – Medium Correlation, 1 – Low Correlation

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

1. Humanities & Social Sciences including Management Courses (H)

Course Code	Course Title	Hours/ Week L	T	P	C
21LEH101T	Communicative English	2	1	0	3
21LEH102T	Chinese	2	1	0	3
21LEH103T	French				
21LEH104T	German				
21LEH105T	Japanese				
21LEH106	Korean				
21LEH107T	Spanish				
21GNH101J	Philosophy of Engineering	1	0	2	2
21PDH201T	Social Engineering	2	0	0	2
21GNH401T	Behavioral Psychology	2	1	0	3
	Total Credits				**13**

2. Basic Science Courses (B)

Course Code	Course Title	Hours/ Week L	T	P	C
21PYB102J	Semiconductor Physics and Computational Methods	3	1	2	5
21CYB101J	Chemistry	3	1	2	5
21MAB101T	Calculus and Linear Algebra	3	1	0	4
21MAB102T	Advanced Calculus and Complex Analysis	3	1	0	4
21MAB201T	Transforms and Boundary Value Problems	3	1	0	4
21MAB204T	Probability and Queueing Theory	3	1	0	4
21MAB302T	Discrete Mathematics	3	1	0	4
21BTB102T	Introduction to Computational Biology	2	0	0	2
	Total Credits				**32**

3. Engineering Science Courses (S)

Course Code	Course Title	Hours/ Week L	T	P	C
21MES101L	Basic Civil and Mechanical Workshop	0	0	4	2
21MES102L	Engineering Graphics and Design	0	0	4	2
21EES101T	Electrical and Electronics Engineering	3	1	0	4
21CSS101J	Programming for Problem Solving	3	0	2	4
21CSS201T	Computer Organization and Architecture	3	1	0	4
21DCS201P	Design Thinking and Methodology	1	2	0	3
21CSS303T	Data Science	2	0	0	2
	Total Credits				**21**

4. Professional Core Courses (C)

Course Code	Course Title	Hours/ Week L	T	P	C
21CSC101T	Object Oriented Design and Programming	2	1	0	3
21CSC201J	Data Structures and Algorithms	3	0	2	4
21CSC202J	Operating Systems	3	0	2	4
21CSC203P	Advanced Programming Practice	3	1	0	4
21CSC204J	Design and Analysis of Algorithms	3	0	2	4
21CSC205P	Database Management Systems	3	1	0	4
21CSC206T	Artificial Intelligence	2	1	0	3
21CSC301T	Formal Language and Automata	3	0	0	3
21CSC302J	Computer Networks	3	0	2	4
21CSC303J	Software Engineering and Project Management	2	0	2	3
21CSC304J	Compiler Design	2	0	2	3
21CSC305P	Machine Learning	2	1	0	3
	Total Credits				**42**

5. Professional Elective Courses (E)
(Any 8 Elective Courses)

Course Code	Course Title	Hours/ Week L	T	P	C
21CSE251T	Digital Image Processing	2	1	0	3
21CSE252T	Biometrics	2	1	0	3
21CSE253T	Internet of Things	2	1	0	3
21CSE254T	Bio Inspired Computing	2	1	0	3
21CSE255T	Computer Graphics and Animation	2	1	0	3
21CSE351T	Computational Logic	2	1	0	3
21CSE352T	Neuro Fuzzy and Genetic Programming	2	1	0	3
21CSE353T	Augmented, Virtual and Mixed Reality	2	1	0	3
21CSE354T	Full Stack Web Development	2	1	0	3
21CSE355T	Data Mining and Analytics	2	1	0	3
21CSE356T	Natural Language Processing	2	1	0	3
21CSE357T	Distributed Computing	2	1	0	3
21CSE358T	Network Security Cryptography and	2	1	0	3
21CSE359T	Information Storage and Management	2	1	0	3
21CSE360T	High Performance Computing	2	1	0	3
21CSE361T	Database Security and Privacy	2	1	0	3
21CSE362T	Cloud Computing	2	1	0	3
21CSE451T	Pattern Recognition Techniques	2	1	0	3
21CSE452T	Semantic Web	2	1	0	3
21CSE453T	Speech Recognition	2	1	0	3
21CSE454T	Computer Vision	2	1	0	3
21CSE455T	Social Network Analysis	2	1	0	3
21CSE456T	Software Defined Networks	2	1	0	3
21CSE457T	Service Oriented Architecture	2	1	0	3
21CSE458T	Wireless and Mobile Communication	2	1	0	3
21CSE459T	Wireless Sensor Networks	2	1	0	3
21CSE460T	Network Protocols and Algorithms	2	1	0	3
	Total Credits				**24**

3. Open Elective Courses (O)
(Any 3 courses)

Course Code	Course Title	Hours/ Week L	T	P	C
21CSO351T	Web Programming	2	1	0	3
21CSO352T	Python Programming	2	1	0	3
21CSO353T	Mobile Application Development	2	1	0	3
21CSO354T	Data Analytics	2	1	0	3
	Total Credits				**9**

7. Project Work, Seminar, Internship In Industry / Higher Technical Institutions (P)

Course Code	Course Title	Hours/ Week L	T	P	C
21GNP301L	Community Connect	0	0	2	1
21CSP302L	Project	0	0	6	3
21CSP303T	MOOC	3	0	0	
21CSP401L	Major Project	0	0	30	15
21CSP402L	Semester Internship				
	Total Credits				**19**

Mandatory Courses (M)

Code	Course Title	L	T	P	C
21PDM101L	Professional Skills and Practices	0	0	2	0
21PDM102L	General Aptitude	0	0	2	0
21PDM201L	Verbal Reasoning	0	0	2	0
21PDM202L	Critical and Creative Thinking Skills	0	0	2	0
21PDM301L	Analytical and Logical Thinking Skills	0	0	2	0
21PDM302L	Employability Skills and Practices	0	0	2	0
21CYM101T	Environmental Science	1	0	0	0
21LEM101T	Constitution of India	1	0	0	0
21LEM201T	Professional Ethics	1	0	0	0
21LEM202T	Universal Human Values	1	0	0	0
21LEM301T	Indian Art Form	1	0	0	0
21LEM302T	Indian Traditional Knowledge	1	0	0	0
21GNM101L	Physical and Mental Health using Yoga	0	0	2	0
21GNM102L	NSS				
21GNM103L	NCC				
21GNM104L	NSO				
	Total Credits				**0**

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

Semester – I

Code	Course Title	Hours/ Week L	T	P	C
21LEH102T	Chinese	2	1	0	3
21LEH103T	French				
21LEH104T	German				
21LEH105T	Japanese				
21LEH106T	Korean				
21LEH107T	Spanish				
21GNH101J	Philosophy of Engineering	1	0	2	2
21MAB101T	Calculus and Linear Algebra	3	1	0	4
21CYB101J	Chemistry	3	1	2	5
21BTB102T	Introduction to Computational Biology	2	0	0	2
21CSS101J	Programming for Problem Solving	3	0	2	4
21MES101L	Basic Civil and Mechanical Workshop	0	0	4	2
21PDM101L	Professional Skills and Practices	0	0	2	0
21GNM101L	Physical and Mental Health using Yoga	0	0	2	0
21GNM102L	NSS				
21GNM103L	NCC				
21GNM104L	NSO				
	Total Credits				**22**

Semester – II

Code	Course Title	Hours/ Week L	T	P	C
21LEH101T	Communicative English	2	1	0	3
21MAB102T	Advanced Calculus and Complex Analysis	3	1	0	4
21PYB102J	Semiconductor Physics and Computational Methods	3	1	2	5
21MES102L	Engineering Graphics and Design	0	0	4	2
21EES101T	Electrical and Electronics Engineering	3	1	0	4
21CSC101T	Object Oriented Design and Programming	2	1	0	3
21CYM101T	Environmental Science*	1	0	0	0
21PDM102L	General Aptitude*	0	0	2	0
21LEM101T	Constitution of India	1	0	0	0
	Total Credits				21

Semester – III

Code	Course Title	Hours/ Week L	T	P	C
21MAB201T	Transforms and Boundary Value Problems	3	1	0	4
21DCS201P	Design Thinking and Methodology	1	2	0	3
21CSS201T	Computer Organization and Architecture	3	1	0	4
21CSC201J	Data Structures and Algorithms	3	0	2	4
21CSC202J	Operating Systems	3	0	2	4
21CSC203P	Advanced Programming Practice	3	1	0	4
21LEM201T	Professional Ethics	1	0	0	0
21PDM201L	Verbal Reasoning	0	0	2	0
	Total Credits				23

Semester – IV

Code	Course Title	Hours/ Week L	T	P	C
21MAB204T	Probability and Queueing Theory	3	1	0	4
21CSC204J	Design and Analysis of Algorithms	3	0	2	4
21CSC205P	Database Management Systems	3	1	0	4
21CSC206T	Artificial Intelligence	2	1	0	3
E	Professional Elective-I				3
21PDH201T	Social Engineering	2	0	0	2
21PDM202L	Critical and Creative Thinking Skills	0	0	2	0
21LEM202T	Universal Human Values	1	0	0	0
	Total Credits				20

Semester – V

Code	Course Title	Hours/ Week L	T	P	C
21MAB302T	Discrete Mathematics	3	1	0	4
21CSC301T	Formal Language and Automata	3	0	0	3
21CSC302J	Computer Networks	3	0	2	4
21CSC305P	Machine Learning	2	1	0	3
E	Professional Elective – II				3
O	Open Elective – I				3
21GNP301L	Community Connect	0	0	2	1
21PDM301L	Analytical and Logical Thinking Skills	0	0	2	0
21LEM301T	Indian Art Form	1	0	0	0
	Total Credits				21

Semester – VI

Code	Course Title	Hours/ Week L	T	P	C
21CSS303T	Data Science	2	0	0	2
21CSC303J	Software Engineering and Project Management	2	0	2	3
21CSC304J	Compiler Design	2	0	2	3
E	Professional Elective – III				3
E	Professional Elective – IV				3
O	Open Elective – II				3
21CSP302L	Project	0	0	6	3
21CSP303T	MOOC	3	0	0	
21PDM302L	Employability Skills and Practices	0	0	2	0
21LEM302T	Indian Traditional Knowledge	1	0	0	0
	Total Credits				20

Semester – VII

Code	Course Title	Hours/ Week L	T	P	C
21GNH401T	Behavioral Psychology	2	1	0	3
E	Professional Elective – V				3
E	Professional Elective – VI				3
E	Professional Elective – VII				3
E	Professional Elective – VIII				3
O	Open Elective –III				3
	Total Credits				18

Semester – VIII

Code	Course Title	Hours/ Week L	T	P	C
21CSP401L	Major Project	0	0	30	15
21CSP402L	Semester Internship				
	Total Credits				15

Course Code	21CSS101J	Course Name	PROGRAMMING FOR PROBLEM SOLVING	Course Category	S	*Engineering Sciences*	L	T	P	C
							3	0	4	5

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

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

CLR-1 :	Think and evolve with a logic to construct an algorithm and pseudocode that can be converted into a program
CLR-2 :	Utilize the appropriate operators and control statements to solve engineering problems
CLR-3 :	Store and retrieve data in a single and multidimensional array
CLR-4 :	Create custom designed functions to perform repetitive tasks in any application
CLR-5 :	Create basic Abstract Data Types with python
CLR-6 :	Create applications using suitable python library functions for solving datascience problems.

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 :	To solve problems through computer programming. Express the basic data types and variables in C	*1*	*3*	*3*	*3*	*3*	-	-	*2*	*2*	*1*	-	*3*	-	-	-
CLO-2 :	To use appropriate data types in simple data processing applications. To create programs using the concept of arrays.	*1*	*3*	*3*	*3*	*3*	-	-	*2*	*2*	*1*	-	*3*	-	-	-
CLO-3 :	To create string processing applications with single and multi-dimensional arrays.	*1*	*3*	*3*	*3*	*3*	-	-	*2*	*2*	*1*	-	*3*	-	-	-
CLO-4 :	To create user defined functions with required operations. To implement pointers in applications with dynamic memory requirements.	*1*	*3*	*3*	*3*	*3*	-	-	*2*	*2*	*1*	-	*3*	-	-	-
CLO-5 :	To create programs using the python data types, loops, control statements for problem solving	*1*	*3*	*3*	*3*	*3*	-	-	*2*	*2*	*1*	-	*3*	-	-	-
CLO-6 :	To implement the suitable python library based solutions for solving statistical problems in data science .	*1*	*3*	*3*	*3*	*3*	-	-	*2*	*2*	*1*	-	*3*	-	-	-

Unit-1 Evolution of Programming & Languages - Problem solving through programming - Writing algorithms & Pseudo code - Single line and multiline comments - Introduction to C: Structure of the C program - Input and output statements. Variables and identifiers, Constants, Keywords - Values, Names, Scope, Binding, Storage Classes - Numeric Data types: integer, floating point
Non-Numeric Data types: char and string - L value and R value in expression, Increment and decrement operator - Comma, Arrow and Assignment operator, Bitwise and Size-of operator - Arithmetic, Relational and logical Operators - Condition Operators, Operator Precedence - Expressions with pre / post increment operator

Unit-2 Conditional Control -Statements :Simple if, if...else - Conditional Statements : else if and nested if - Conditional Statements : Switch case - Un-conditional Control Statements : break, continue, goto - Looping Control Statements:for, while, do..while - Looping Control Statements: nested for, nested while - Introduction to Arrays -One Dimensional (1D) Array Declaration and initialization - Accessing, Indexing and operations with 1D Arrays - Array Programs – 1D - Initializing and Accessing 2D Array, Array Programs – 2D - Pointer and address-of operators -Pointer Declaration and dereferencing, Void Pointers, Null pointers
Pointer based Array manipulation

Unit-3 String Basics - String Declaration and Initialization - String Functions: gets(), puts(), getchar(),putchar(), printf() - Built-inString Functions: atoi, strlen, strcat, strcmp -String Functions: sprint, sscanf, strrev, strcpy, strstr, strtok - Operations on Strings - Function prototype declaration, function definition - Actual and formal parameters - Function with and without Arguments - Function with and without return values - Call by Value, Call by Reference - Passing Array to Function - Passing Array elements to Function - Function Pointers

Unit-4 Python: Introduction to Python - Introduction to Google Colab - Basic Data Types: Integers, Floating Points, Boolean types - Working with String functions - Working with Input, Output functions - Python-Single and Multi line Comments/ Error Handling - Conditional & Looping Statements : If, for, while statements - Working with List structures - Working with Tuples data structures - Working with Sets - Working with Dictionaries - Introduction to Python Libraries - Introduction to Numpy - High Dimensional Arrays

Unit-5 Creating NumPy Array -Numpy Indexing - Numpy Array attributes - Slicing using Numpy - Descriptive Statistics in Numpy: Percentile - Variance in Numpy -Introduction to Pandas - Creating Series Objects, Data Frame Objects - Simple Operations with Data frames - Querying from Data Frames -Applying Functions to Data frames - Comparison between Numpy and Pandas - Speed Testing between Numpy and Pandas - Other Python Libraries

Lab Lab 1: Input, Output Statements, Variables Lab 2: Data types & Operators-I Lab 3: Data types & Operators-II Lab 4: Control Statements (Branching, Looping) Lab 5: Arrays Lab 6: Arrays with Pointers Lab 7: Strings Lab 8: Functions Lab 9 : Arrays and Functions Lab 10: Input, Output in Python Lab 11: Python data structures Lab 12: Arrays in Python Lab 13: Operations with Numpy Lab 14: Operations with Pandas Lab 15: case study: Data science with Numpy, Pandas

Learning Resources	Reference Books (C): 1. Programming in C, E.Balagurusamy,Mc Graw Hill, Eighth Edition.2019. [chapters 1 to 6 & 8 To 11] 2. Head First C: A Brain-Friendly Guide, By David Griffiths, Dawn Griffiths,Oreilly. [Chapters 2 to 4] 3. Let Us C, Fifth Edition, Yashavant P. Kanetkar,BPB publications.[Chapters 1 to 6, 8 to 9] 4. Problem Solving & Programming Concepts, Maureen Sprankle, Jim Hubbard, Prentice Hall, Ninth Edition. [Chapters 1 to 7] 5. https://www.tutorialspoint.com/cprogramming/index.htm 6. https://www.geeksforgeeks.org/c-programming-language/	Reference Books (Python): 7. Python Datascience Handbook, Oreilly,Jake VanderPlas, 2017.[Chapters 2 &3] 8. Python For Beginners, Timothy C.Needham,2019. [Chapters 1 to 4] 9. https://www.tutorialspoint.com/python/index.htm 10. https://www.w3schools.com/python/

	Bloom's Level of Thinking	Formative CLA – 1 Average of unit test (45%)		Life Long Learning CLA – 2 Practice (15%)		Summative Final Examination (40% Weightage)	
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	-	0%	20%	-
Level 2	Understand	40%	-	-	40%	40%	-
Level 3	Apply	20%	-	-	40%	20%	-
Level 4	Analyze	20%	-	-	10%	10%	-
Level 5	Evaluate	0%	-	-	10%	10%	-
Level 6	Create	0%	-	-	0%	0%	-
	Total	100 %		100 %		100 %	

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. E.Poovammal, 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	21CSS201T	Course Name	COMPUTER ORGANIZATION AND ARCHITECTURE	Course Category	S	Engineering Sciences	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*

Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	*Nil*

Course Objectives:	*The purpose of learning this course is to:*
CLR-1	Understand the Fundamentals of computers, Memory operations and Addressing Modes
CLR-2	Know about Functions of Arithmetic and Logic unit
CLR-3	Explore the Operations of Control Unit, Execution of Instruction and Pipelining
CLR-4	Classify the Need for Parallelism, Multicore and Multiprocessor Systems
CLR-5	Understand the Concepts and functions of Memory unit, I/O unit

Course Outcomes (CO):	*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
CO-1	Identify the computer hardware and how software interacts with computer hardware	3	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO-2	Apply Boolean algebra as related to designing computer logic ,through simple combinational and sequential logic circuits	3	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO-3	Examine the detailed operation of Basic Processing units and the performance of Pipelining	3	-	-	-	-	-	-	-	-	-	-	-	-	-	1
CO-4	Analyze concepts of parallelism and multi-core processors.	3	-	-	-	-	-	-	-	-	-	-	-	-	2	-
CO-5	Classify the memory technologies, input-output systems and evaluate the performance of memory system	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-

Unit 1: Introduction to Number System and Logic Gates: Number Systems- Binary, Decimal, Octal, Hexadecimal; Codes- Grey, BCD,Excess-3, ASCII, Parity; Binary Arithmetic- Addition, Subtraction, Multiplication, Division using Sign Magnitude,1's compliment, 2's compliment, BCD Arithmetic; Logic Gates-AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.
Unit 2 : Basic structure of computers: Functional Units of a computer, Operational concepts, Bus structures, Memory addresses and operations, assembly language , Instructions, Instruction sequencing, Addressing modes. Case study: 8086.
Unit 3: Design of ALU: De Morgan's Theorem, Adders, Multiplier – Unsigned, Signed, Fast, Carry Save Addition of summands; Division–Restoring and Non-Restoring; IEEE 754 Floating point numbers and operations.
Unit 4: Control Unit: Basic processing unit, ALU operations, Instruction execution, Branch instruction, Multiple bus organization, Hardwired control, Generation of control signals, Micro-programmed control; Pipelining: Basic concepts of pipelining, Performance, Hazards-Data, Instruction and Control, Influence on instruction sets.
Unit 5: Parallelism: Need, types , applications and challenges, Architecture of Parallel Systems-Flynn's classification; ARM Processor: The thumb instruction set, Processor and CPU cores, Instruction Encoding format, Memory load and Store instruction, Basics of I/O operations. Case study: ARM 5 and ARM 7 Architecture.

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

	Bloom's Level of Thinking	**Continuous Learning Assessment (CLA) - By the Course Faculty**		**By The CoE**
		Formative CLA-I Average of unit test (50%)	**Life Long* Learning** CLA-II- Practice (10%)	**Summative** Final Examination (40% weightage)

		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*30%*	-	*30%*	-	*30%*	-
Level 2	Understand	30%	-	30%	-	30%	-
Level 3	Apply	*20%*	-	*20%*	-	*20%*	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr.Saminath Sanjai, Borqs Technologies,Inc. Bengaluru		1.Dr.K.Vijaya, Dr.Anitha D, SRMIST

Course Code	21CSC101T	Course Name	OBJECT ORIENTED DESIGN AND PROGRAMMING	Course Category	C	Professional Core	L	T	P	C
							2	1	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Mechanical*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Programs using object-oriented approach and design methodologies for real-time application development*
CLR-2 :	*Method overloading and operator overloading for real-time application development programs*
CLR-3 :	*Inline, friend and virtual functions and create application development programs*
CLR-4 :	*Exceptional handling and collections for real-time object-oriented programming applications*
CLR-5 :	*Model the System using Unified Modelling approach using different diagrams*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO) (1- Low, 2 – Medium, or High-3)											
		1	2	3	4	5	6	7	8	9	10	11	12
		Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning
CO-1 :	*Create programs using object-oriented approach and design methodologies*	*3*	*3*	-	-	-	-	-	-	-	-	-	-
CO-2 :	*Construct programs using method overloading and operator overloading*	*3*	*2*	-	-	-	-	-	-	-	-	-	-
CO-3 :	*Create programs using inline, friend and virtual functions, construct programs using standard templates*	*3*	*2*	-	-	-	-	-	-	-	-	-	-
CO-4 :	*Construct programs using exceptional handling and collections*	*3*	*2*	-	-	-	-	-	-	-	-	-	-
CO-5 :	*Create Models of the system using UML Diagrams*	*2*	*2*	-	-	-	-	-	-	-	-	-	-

Unit-1: Introduction to OOPS **9 Hours**

Unit- 1 Object-Oriented Programming - Features of C++ - I/O Operations, Data Types, Variables-Static, Constants-Pointers-Type Conversions – Conditional and looping statements – Arrays - C++ 11 features - Class and Objects, Abstraction and Encapsulation, Access Specifiers, Methods- UML Diagrams Introduction - UseCase Diagram - Class Diagram.

Unit-2: Methods and Polymorphism **9 Hours**

Constructors- Types of constructors - Static constructor and Copy constructor -Destructor - Polymorphism: Constructor overloading - Method Overloading Operator Overloading - UML Interaction Diagrams -Sequence Diagram - Collaboration Diagram - Example Diagram

Unit-3: Inheritance **9 Hours**

Inheritance – Types -Single and Multiple Inheritance - Multilevel Inheritance - Hierarchical Inheritance - Hybrid Inheritance - Advanced Functions - Inline, Friend- Virtual - Pure Virtual function - Abstract class - UML State Chart Diagram - UML Activity Diagram

Unit-4: Generic Programming **9 Hours**

Generic - Templates - Function templates - Class Templates - Exceptional Handling: try and catch - Multilevel exceptional - throw and throws - finally - User defined exceptional - Dynamic Modeling: Package Diagram - UML Component Diagram - UML Deployment Diagram

Unit-5: Standard Template Library **9 Hours**

STL: Containers: Sequence and Associative Container - Sequence Container: Vector, List, Deque, Array, Stack - Associative Containers: Map, Multimap - Iterator and Specialized iterator - Functions of iterator - Algorithms: find(), count(), sort() - Algorithms: search(), merge(), for_each(), transform()

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*

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA) - By the Course Faculty				By The CoE	
		Formative CLA-I Average of unit test (50%)		**Life Long* Learning** CLA-II- Practice (10%)		**Summative** Final Examination (40% weightage)	
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20	-	20	-	20	-
Level 2	Understand	20	-	20	-	20	-
Level 3	Apply	30	-	30	-	30	-
Level 4	Analyze	30	-	30	-	30	-
Level 5	Evaluate	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-
	Total	100 %		100 %		100 %	

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.Prof. R. Golda Brunet, GCE, goldabrunet@gcessalem.edu.in	1. Mr.C.Arun, SRMIST
2. Mr. Janmajay Singh, Fuji Xerox R&D, Japan, janmajaysingh14@gmail.com		2. Mrs.C.G.Anupama, SRMIST

Course Code	21CSC201J	Course Name	DATA STRUCTURES AND ALGORITHMS	Course Category	C	Professional Core	L	T	P	C
							3	0	2	4

Pre-requisite Courses	Principles of Programming Practices	Co-requisite Courses	Nil	Progressive Courses	Design and Analysis of Algorithms
Course Offering Department	Department of Computing Technologies	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Structures, pointers, searching, sorting techniques used to handle a set of data along with time and space complexity
CLR-2 :	List structure and its categories
CLR-3 :	Linear structures Stack and Queue
CLR-4 :	Tree structure with its applications and hashing methods
CLR-5 :	Structures Graphs and implement them
CLR-6 :	Different types of data structures and use them for problem solving

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CO-1 :	Develop programs using data types like structures, pointers and arrays supported by C programming language	1	-	3	-	-	-	-	-	2	-	-	-	1	-	2
CO-2 :	Analyze the complexity of algorithm and if needed, modify it to improve its efficiency	2	3	-	1	-	-	-	-	-	-	-	-	1	2	-
CO-3 :	Identify and Use appropriate data structure for devising solution	1	3	2	-	-	-	-	-	-	-	-	-	1	1	2
CO-4 :	Describe and use tree structure while developing programs	2	-	3	2	-	-	-	-	-	-	-	-	1	-	2
CO-5 :	Implement the Graph structure and use it whenever deemed necessary for providing better solution	3	2	3	-	-	-	-	-	-	-	-	-	1	1	2
CO-6 :	Decide and use appropriate searching and sorting algorithms while developing solutions for specific problems	1	3	-	2	-	-	-	-	-	-	-	-	1	1	1

Unit-1 Introduction Programming in C - Primitive data types, Structures, Self-referential structures, Pointers and structures, Dynamic memory allocation, Matrix multiplication; Data Structure – Definition, Types, ADT, Operations; Mathematical notations - Big O, Omega and Theta, Complexity – Time, Space, Trade off.
Unit-2 List Structure Operations on List ADT – Create, Insert, Search, Delete, Display elements; Implementation of List ADT– Array, Cursor based and Linked; Types – Singly, Doubly, Circular; Applications - Sparse Matrix, Polynomial Arithmetic, Joseph Problem
Unit-3 Stack and Queue Operations on Stack ADT – Create, Push, Pop, Top; Implementation of Stack ADT – Array and Linked; Applications - Infix to Postfix Conversion, Postfix Evaluation, Balancing symbols, Function Calls, Tower of Hanoi; Operations on Queue ADT - Create, Enqueue and Dequeue; Implementation of Queue ADT – Array and Linked; Types of Queue - Circular, Double ended and Priority Queue, Applications – Scheduling
Unit-4 Trees and Hashing Introduction to Trees, Tree traversals, Complete Binary Tree and its height, Binary Search Trees, Need for Balance, Rotation, AVL trees, B Trees, Heaps, trees and array implementations and applications; Hash functions - Introduction, functions, Collision avoidance, Separate chaining, Open Addressing, Linear Probing, Quadratic probing.
Unit-5 Graph Introduction to Graph, Graph Traversal, Topological sorting, Minimum spanning tree – Prims Algorithm, Kruskal's Algorithm, Shortest Path Algorithm - Dijkstra's Algorithm

Lab Lab 1: Implementation of Structures Lab 2: Implementation of Structures using Pointers Lab 3: Implementation of Matrix Multiplication – Dynamic Memory allocation Lab 4: Array Implementation of List Lab 5: Implementation of Linked List Lab 6: Implementation of Doubly linked List Lab 7: Implementation of Stack using array and Linked List Lab 8: Implementation of Queue using array and Linked list Lab 9: Applications of Stack, Queue Lab 10: Implementation of Tree using array Lab 11: Implementation of BST using linked list Lab 12: Implementation of B-Trees Lab 13: Implementation of Graph using Array Lab 14: Implementation of Shortest path Algorithm Lab 15: Implementation of Minimal Spanning Tree

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

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA) - By the Course Faculty				By The CoE	
		Formative CLA-I Average of unit test (50%)		**Life Long* Learning** CLA-II- Practice (10%)		**Summative** Final Examination (40% weightage)	
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*25%*	-	-	*10%*	*25%*	-
Level 2	Understand	*25%*	-	-	*20%*	*25%*	-
Level 3	Apply	*20%*	-	-	*30%*	*20%*	-
Level 4	Analyze	*20%*	-	-	*30%*	*20%*	-
Level 5	Evaluate	*10%*	-	-	*10%*	*10%*	-
Level 6	Create	-	-	-	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr. Mariappan Vaithilingam, Senior Engineering Manager, Uber India Research and Development Pvt Centre, Bangalore.	Dr. Venkatesh Raman, Professor Mathematical Institute of Science	1. Dr. K. Vijaya, SRMIST
		2. Dr. S. Poornima, SRMIST
		3. Dr. K. Venkatesh, SRMIST

Course Code	21CSC202J	Course Name	OPERATING SYSTEMS	Course Category	C	Professional Core	L	T	P	C
							3	0	2	4

Pre-requisite Courses	*COA*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*

Course Offering Department	Electrical and Electronics Engineering	Data Book / Codes/Standards

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	Outline the structure of OS and basic architectural components involved in OS design
CLR-2 :	Introduce the concept of deadlock and various memory management mechanism
CLR-3 :	Familiarize the scheduling algorithms, file systems, and I/O schemes
CLR-4 :	Identify and tell the various embedded operating systems and computer security concepts
CLR-5 :	Name the various computer security techniques in windows and Linux

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 :	Use the appropriate concepts of operating system for resource utilization	3	3	2	2	-	-	-	-	-	-	-	3	-	-	-
CLO-2 :	Choose the relevant process and thread concepts for solving synchronization problems	3	3	3	2	-	-	-	-	-	-	-	3	-	-	-
CLO-3 :	Exemplify different types of scheduling algorithms and deadlock mechanism.	3	3	3	2	-	-	-	-	-	-	-	3	-	-	-
CLO-4 :	Experiment the performance of different algorithms used in management of memory, file and I/O and select the appropriate one.	3	3	3	2	-	-	-	-	-	-	-	3	-	-	-
CLO-5 :	Demonstrate different device and resource management techniques for memory utilization with security mechanisms	3	2	3	2	-	-	-	-	-	-	-	3	-	-	-

Unit-1

Introduction, Computer-System Organization, Computer-System Architecture, Operating-System Structure, Operating-System Operations, Process Management, Memory Management, Storage Management, Protection and Security, Kernel Data Structures, Computing Environments, Open-Source Operating Systems, Operating-System Services, User and Operating-System Interface, System Calls, Types of System Calls, System Programs, Operating-System Design and Implementation, Operating-System Structure, Operating-System Debugging, Operating-System Generation, System Boot.

Unit-2

PROCESS MANAGEMENT: Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication, Communication in Client– Server Systems, Threads: Multicore Programming, Multithreading Models, Thread Libraries, Implicit Threading, Threading Issues. Process Synchronization: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors

Unit-3

CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Multiple-Processor Scheduling, Real-Time CPU Scheduling. Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock

Unit-4

MEMORY MANAGEMENT: Main Memory, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table. Virtual Memory: Introduction, Demand Paging, Copy-on-Write, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory. STORAGE MANAGEMENT: Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure. File-System Interface: File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing, Protection. .

Unit-5

PROTECTION AND SECURITY: Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix, Implementation of the Access Matrix, Access Control, Revocation of Access Rights, Capability-Based Systems, Language-Based Protection, The Security Problem, Program Threats, System and Network Threats, Cryptography as a Security Tool, User Authentication, Implementing Security Defenses, Firewalling to Protect Systems and Networks, Computer-Security
Classifications.

Lab 1: Operating system Installation, Basic Linux commands
Lab 2: Process Creation using fork() and Usage of getpid(), getppid(), wait() functions
Lab 3: Multithreading
Lab 4: Mutual Exclusion using semaphore and monitor
Lab 5: Reader-Writer problem
Lab 6: Dining Philosopher problem
Lab 7: Bankers Algorithm for Deadlock avoidance

Lab 8: FCFS and SJF Scheduling Lab 9: Priority and Round robin scheduling Lab 10: FIFO Page Replacement Algorithm Lab 11: LRU and LFU Page Replacement Algorithm Lab 12: Best fit and Worst fit memory management policies Lab 13: Disk Scheduling algorithm Lab 14: Sequential and Indexed file Allocation Lab 15: File organization schemes for single level and two level directory

Learning Resources	1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", John Wiley & Sons (Asia) Pvt. Ltd, Tenth Edition, 2018 2. RamazElmasri, A. Gil Carrick, David Levine, "Operating Systems – A Spiral Approach ", Tata McGraw Hill Edition, 2010 3. Dhananjay M. Dhamdhere, "Operating Systems – A Concept Based Approach", Third Edition, Tata McGraw Hill Edition, 2019 4. *Andrew S. Tanenbaum, "Modern Operating Systems", Fourth Edition, Global Edition, Pearson, 2015.* 5. *William Stallings, "Operating Systems: Internals and Design Principles", Pearson Education, Sixth Edition, 2018.* 6. *Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education, 2017.*	7. *https://nptel.ac.in/courses/106/105/106105214/* 8. *https://nptel.ac.in/courses/106/106/106106144/* 9. https://nptel.ac.in/courses/106/102/106102132/ 10. https://onlinecourses.nptel.ac.in/noc21_cs44/preview 11. *https://nptel.ac.in/courses/106/105/106105172/*

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA) - By the Course Faculty				By The CoE	
		Formative CLA-I Average of unit test (50%)		**Life Long* Learning** CLA-II- Practice (10%)		**Summative** Final Examination (40% weightage)	
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	-	-	**0%**	**20%**	-
Level 2	Understand	*40%*	-	-	**40%**	**40%**	-
Level 3	Apply	*20%*	-	-	**40%**	**20%**	-
Level 4	Analyze	*20%*	-	-	**10%**	**10%**	-
Level 5	Evaluate	-	-	-	**10%**	**10%**	-
Level 6	Create	-	-	-	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.T.Madhan, Team Leader, Tata Consultancy Services, siruseri Campus, Chennai, madhan.tk@gmail.com	*1. Dr. S. Janakiraman, Associate Professor, Pondicherry University, sj.dbt@pondiuni.edu.in*	1. Dr. N. Prasath, Associate Professor, SRMIST
2. Mrs.K.Saranya, IT Analyst, Tata Consultancy Services, siruseri Campus, Chennai, saranya.k6@gmail.com	*2. Dr. R.Shyamala, Associate Professor, Anna University College of Engineering Tindivanam, vasuchaaru@gmail.com*	2. Dr. M. Eliazer, Assistant Professor, SRMIST

Course Code	21CSC203P	Course Name	Advanced Programming Practice	Course Category	P	Professional Core	L	T	P	C
							3	1	0	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil

Course Offering Department	Computational Intelligence	Data Book / Codes/Standards

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1	Understand the paradigm functionalities and their hierarchy
CLR-2	Deploy structural, procedural, and Object-Oriented Programming Paradigm
CLR-3	Demonstrate the event, Graphical User Interface, and declarative Paradigm with a java application.
CLR-4	Extended knowledge on logic, functional, network and concurrent Paradigm
CLR-5	Symbolic, Automata-based, and Event with a python application.

Course Outcomes (CO): (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual &Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO – 2	PSO – 3
CO-1	Devise solutions to the various programming paradigm	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2	Express proficiency in the usage of structural, procedural, and Object-Oriented Program	3	2	-	1	-	-	-	-	-	-	-	-	-	-	-
CO-3	Determine the Java application using declarative, event, and graphical user interface paradigm	3	-	2	1	2	-	-	-	1	-	-	-	-	-	-
CO-4	Express proficiency in the usage of logic, functional, network, and concurrent Paradigm	3	2	-	1	-	-	-	-	-	-	-	-	-	-	-
CO-5	Determine the Python application using symbolic, automata-based, and graphical user interface programming paradigms	3	-	2	1	2	-	-	-	1	-	-	-	-	-	-

Unit 1 – INTRODUCTION TO PROGRAMMING PARADIGM

Programming Languages – Elements of Programming languages - Programming Language Theory - Bohm- Jacopini structured program theorem - Multiple Programming Paradigm – Programming Paradigm hierarchy – Imperative Paradigm: Procedural, Object-Oriented and Parallel processing – Declarative programming paradigm: Logic, Functional and Database processing - Machine Codes – Procedural and Object-Oriented Programming – Suitability of Multiple paradigms in the programming language - Subroutine, method call overhead and Dynamic memory allocation for message and object storage - Dynamically dispatched message calls and direct procedure call overheads – Object Serialization – parallel Computing.

Unit 2 – JAVA PROGRAMMING PARADIGMS

Object and Classes; Constructor; Data types; Variables; Modifier and Operators - Structural Programming Paradigm: Branching, Iteration, Decision making, and Arrays - Procedural Programming Paradigm: Characteristics; Function Definition; Function Declaration and Calling; Function Arguments - Object-Oriented Programming Paradigm: Abstraction; Encapsulation; Inheritance; Polymorphism; Overriding - Interfaces: Declaring, Implementing; Extended and Tagging - Package: Package Creation.

Unit 3 – ADVANCED JAVA PROGRAMMING PARADIGMS

Concurrent Programming Paradigm: Multithreading and Multitasking; Thread classes and methods - Declarative Programming Paradigm: Java Database Connectivity (JDBC); Connectivity with MySQL – Query Execution; - Graphical User Interface Based Programming Paradigm: Java Applet: Basics and Java Swing: Model View Controller (MVC) and Widgets; Develop a java project dissertation based on the programming paradigm.

Unit 4 – PYTHONIC PROGRAMMING PARADIGM

Functional Programming Paradigm: Concepts; Pure Function and Built-in Higher-Order Functions; Logic Programming Paradigm: Structures, Logic, and Control; Parallel Programming Paradigm: Shared and Distributed memory; Multi-Processing – Ipython; Network Programming Paradigm: Socket; Socket Types; Creation and Configuration of Sockets in TCP / UDP – Client / Server Model.

Unit 5 – FORMAL AND SYMBOLIC PROGRAMMING PARADIGM
Automata Based programming Paradigm: Finite Automata – DFA and NFA; Implementing using Automaton Library - Symbolic Programming Paradigm: Algebraic manipulations and calculus; Sympy Library - Event Programming Paradigm: Event Handler; Trigger functions and Events – Tkinter Library. Develop a python-based project dissertation based on the programming paradigm.

Learning Resources	1. Elad Shalom, A Review of Programming Paradigms throughout the History: With a suggestion Toward a Future Approach, Kindle Edition, 2018 2. Maurizio Gabbrielli , Simone Martini, Programming Languages: Principles and Paradigms, 2010.	3. Herbert Schildt, Java: The Complete Reference Seventh Edition, 2016. 4. Mark Lutz, Programming Python: Powerful Object-Oriented Programming, 2011.

Learning Assessment										
Bloom'sLevel of Thinking		Continuous Learning Assessment (CLA) - By the Course Faculty						By The CoE		
		CLA-1 Average of Unit test (20%)		CLA-2 Project Based Learning (60%)		Report and Viva Voce (20% Weightage)		Final Examination (0% weightage)		
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	
Level 1	Remember	30	-	--	20	-	10	-	-	
Level 2	Understand	30	-	-	20	-	10	-	-	
Level 3	Apply	20	-	-	20	-	10	-	-	
Level 4	Analyze	20	-	-	20	-	10	-	-	
Level 5	Evaluate	-	-	-	10	-	30	-	-	
Level 6	Create	-	-	-	10	-	30	-	-	
Total		100 %		100 %		100 %		-		

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. N. Venkatesh, Tech Lead, Honeywell, Bengaluru, Karnataka, India	Dr. Sudeepta Mishra, Assistant Professor, Computer Science and Engineering, Indian Institute of Information Technology, Ropar, Punjab.	Dr Ramkumar J, Assistant Professor, Computing Technologies, SRM Institute of Science and Technology, KTR Campus, Chennai

Course Code	21CSC204J	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	
Course Offering Department	Data Science and Business Systems	Data Book / Codes/Standards	Nil		

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

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CO-1 :	Apply efficient algorithms to reduce space and time complexity of both recurrent and non-recurrent relations	2	1	2	1	-	-	-	-	-	3	-	3	1	1	2
CO-2 :	Solve problems using divide and conquer approaches	2	1	2	1	-	-	-	-	-	3	-	3	1	1	2
CO-3 :	Apply greedy and dynamic programming types techniques to solve polynomial time problems.	2	1	2	1	-	-	-	-	-	3	-	3	1	1	2
CO-4 :	Create exponential problems using backtracking and branch and bound approaches.	2	1	2	1	-	-	-	-	-	3	-	3	1	1	2
CO-5 :	Interpret various approximation algorithms and interpret solutions to evaluate P type, NP Type, NPC, NP Hard problems	2	1	2	1	-	-	-	-	-	3	-	3	1	1	2

Unit-1 Introduction-Algorithm Design - Fundamentals of Algorithms- Correctness of algorithm - Time complexity analysis - Insertion sort-Line count, Operation count Algorithm Design paradigms - Designing an algorithm And its analysis-Best, Worst and Average case - Asymptotic notations Based on growth functions. O,O,θ, ω, Ω - Mathematical analysis - Induction, Recurrence relations -Solution of recurrence relations - Substitution method - Solution of recurrence relations - Recursion tree - Solution of recurrence relations - examples.

Unit-2 Introduction-Divide and Conquer - Maximum Subarray Problem Binary Search - Complexity of binary search Merge sort - Time complexity analysis -Quick sort and its Time complexity analysis Best case, Worst case, Average case analysis - Strassen's Matrix multiplication and its recurrence relation - Time complexity analysis of Merge sort - Largest sub-array sum - Time complexity analysis of Largest sub-array sum - Master Theorem Proof - Master theorem examples - Finding Maximum and Minimum in an array - Time complexity analysis-Examples - Algorithm for finding closest pair problem - Convex Hull problem

Unit-3 Introduction-Greedy and Dynamic Programming - Examples of problems that can be solved by using greedy and dynamic approach Huffman coding using greedy approach Comparison of brute force and Huffman method of encoding - Knapsack problem using greedy approach Complexity derivation of knapsack using greedy - Tree traversals - Minimum spanning tree – greedy Kruskal's algorithm - greedy - Minimum spanning tree - Prims algorithm Introduction to dynamic programming - 0/1 knapsack problem - Complexity calculation of knapsack problem - Matrix chain multiplication using dynamic programming - Complexity of matrix chain multiplication - Longest common subsequence using dynamic programming - Explanation of LCS with an example - Optimal binary search tree (OBST)using dynamic programming - Explanation of OBST with an example.

Unit-4 Introduction to backtracking - branch and bound - N queen's problem – backtracking - Sum of subsets using backtracking Complexity calculation of sum of subsets Graph introduction Hamiltonian circuit - backtracking - Branch and bound - Knapsack problem Example and complexity calculation. Differentiate with dynamic and greedy Travelling salesman problem using branch and bound - Travelling salesman problem using branch and bound example - Travelling salesman problem using branch and bound example - Time complexity calculation with an example - Graph algorithms - Depth first search and Breadth first search - Shortest path introduction - Floyd-Warshall Introduction - Floyd-Warshall with sample graph - Floyd-Warshall complexity

Unit-5. Introduction to randomized and approximation algorithm - Randomized hiring problem Randomized quick sort Complexity analysis
String matching algorithm Examples - Rabin Karp algorithm for string matching Example discussion - Approximation algorithm - Vertex covering - Introduction Complexity classes - P type problems - Introduction to NP type problems - Hamiltonian cycle problem - NP complete problem introduction - Satisfiability problem - NP hard problems – Examples

Lab 1: Simple Algorithm-Insertion sort Lab 2: Bubble Sort Lab 3: Recurrence Type-Merge sort, Linear search Lab 4: Quicksort, Binary search Lab 5: Strassen Matrix multiplication Lab 6: Finding Maximum and Minimum in an array, Convex Hull problem Lab 7: Huffman coding, knapsack and using greedy Lab 8: Various tree traversals, Lab 9: Longest common subsequence Lab 10: N queen's problem Lab 11: Travelling salesman problem Lab 12: BFS and DFS implementation with array Lab 13: Randomized quick sort Lab 14: String matching algorithms 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

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA) - By the Course Faculty				By The CoE	
		Formative CLA-I Average of unit test (50%)		**Life Long* Learning** CLA-II- Practice (10%)		**Summative** Final Examination (40% weightage)	
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	30	-	-	30	30	-
Level 2	Understand	70	-	-	30	30	-
Level 3	Apply		-	-	40	40	-
Level 4	Analyze		-	-			-
Level 5	Evaluate	-	-	-			-
Level 6	Create	-	-	-	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
G. Venkiteswaran, Wipro Technologies, gvenki@pilani.bits-pilani.ac.in	Mitesh Khapra, IITM Chennai, miteshk@cse.iitm.ac.in	1. Dr. .K.Senthil Kumar, SRMIST
Dr.Sainarayanan Gopalakrishnan, HCL Technologies, sai.jgk@gmail.com	2. V. Masilamani. IIITDM, masila@iiitdm.ac.in	2. Dr. V. Sivakumar, SRMIST
		3. Dr. R.Vidhya,SRMIST

Course Code	21CSC205P	Course Name	Database Management Systems	Course Category	C	Engineering Sciences	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:*
CLR-1 :	Understand the fundamentals and need of Database systems, Architecture,Languages
CLR-2 :	Conceive database design through Relational model, Relational Algebra
CLR-3 :	Design Logical schema with constraints, Familiarize SQL Queries
CLR-4 :	Standardization of Database through Normalization
CLR-5 :	Understand Storage Management, the practical problems of Concurrency control, Failures and recovery,NoSQL database

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 knowledge on DBMS architecture and languages		2	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	Acquire knowledge on Relational languages and design a database	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Implement the Database structure with SQL	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Removal of anomalies using Normalization concepts	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Visualizing storage structure, handling concurrency , Failure and recovery principles,NoSQL concept	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-

Unit-1

Issues in File Processing System, Need for DBMS, Basic terminologies of Database, Database system Architecture, Various Data models, ER diagram basics and extensions, **Case study :** Construction of Database design using Entity Relationship diagram for an application such as University Database, Banking System, Information System

Unit-2

Conversion of ER model to Relational Table, **Case study :** Apply conversion concept. Discussion of various design issues. Pitfalls in Relational Database systems, Understanding various Relational languages such as Tuple Relational calculus, Domain relational calculus, Calculus Vs Algebra, Computational capabilities . **Case Study :** Applying Relational Algebra for all the queries of application Designed.

Unit-3

SQL commands, Constraints, Joins, Set operations, Sub queries, Views, PL – SQL, Triggers, Cursors. **Case Study :** Implement all the queries using SQL, PL-SQL, Cursor and Triggers

Unit-4

Normalization, Need for Normalization, NF1,NF2,NF3, NF4, NF5. **Case study :** Apply Conversion rules and normalize the Database

Unit-5

Storage Structure, Transaction control , Concurrency control algorithms, Issues in Concurrent execution, Failures and Recovery algorithms **Case study :** Demonstration of Entire project by applying all the concepts learnt with minimum Front end requirements, NoSQL Databses-Document Oriented, Key value pairs, Column Oriented and Graph

Learning Resources	12. *Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Database System Conceptsll, Seventh Edition, Tata McGraw Hill,2019.* 13. *Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systemsll, Sixth Edition, Pearson Education,2011.* 14. *CJ Date,A Kannan,S Swamynathan, An Introduction to Database Systems, Eight Edition, Pearson Education,2006.*	4. *RaghuramaKrishnan,Johannes Gehrke,Database Management Systems,3rdEdition,McGrawHill Education,2003.* 5. *Principles of Database Systems, J.D.Ullman, Galgoti,1982* 6. *NoSQL Distilled, A brief guide to the emerging world of Polygot persistence,First Edition,Promod J,Sadalage Martin Fowler,2012*

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA) - By the CourseFaculty						By The CoE	
		CLA-1 Average ofunit test (20%)		CLA-2 ProjectBased Learning(60%)		Report and VivaVoce (20% Weightage)		Final Examination (0% weightage)	
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	-	%	-	%	-	-
Level 2	Understand	40%	-	-	%	-	%	-	-
Level 3	Apply	40%	-	-	30%	-	%	-	-
Level 4	Analyze	%	-	-	30%	-	%	-	-
Level 5	Evaluate	%	-	-	%	-	50%	-	-
Level 6	Create	%	-	-	40%	-	50%	-	-
	Total	100 %		100 %		100%			

Assessment Procedure

CLA-1 (20)

Written Test For UNIT 1 for a weightage of **15 marks**

Project Selection **(5 marks)**

CLA – 2 (60)

Internal Reviews

First Review - Database design using Entity Relationship diagram **(15 marks)**

Second Review – Applying Relational Algebra **(10 marks)**

Third Review - Implementation of SQL Queries **(20 Marks)**

Fourth Review - Standardization of Database using Normalization , Application on NoSQL concept to some portion of the application **(15 marks)**

Report and Viva - Report Documentation and Viva (**20 marks)**

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Ms.Sangeetha Jayaprakash, Database Architect, BOSCH India	1. Dr.J.Sheeba Rani, Indian Institute of Space Science and Technology, Trivandrum	1. Dr.M.Thenmozhi,NWC
2. Dr.Manipoonchelvi, Senior Technical Manager, HCL Technologies	2. Dr.K.Nandhini, Central University of Thiruvarur	2. Ms.K.Srividya, DSBS

Course Code	21CSC206T	Course Name	Artificial Intelligence	Course Category	C	Professional Core	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computational Intelligence	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Infer knowledge in problem formulation with AI.
CLR-2 :	Exemplify the uninformed and informed search technique procedures for real world problems
CLR-3 :	Understand the adversarial search methods, constraint satisfaction problems and intelligent agents.
CLR-4 :	Demonstrate various knowledge representation techniques
CLR-5 :	Infer knowledge about expert systems.

Course Outcomes (CO):	At the end of this course, learners will be able to:
CO-1	Formulate a problem as a state space search method and its solution using various AI techniques
CO-2	Apply appropriate searching techniques to solve a real-world problem
CO-3	Develop various game playing strategies to solve real world adversarial search problems
CO-4	Represent various knowledge representation techniques to solve complex AI problems
CO-5	Design an expert system to implement advance techniques in Artificial Intelligence

Program Outcomes (PO):

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

Unit-1
Introduction to AI- AI techniques, Problem solving with AI, AI Models, Data acquisition and learning aspects in AI, Problem solving- Problem solving process, formulating problems, Problem types and characteristics, Problem space and search, Toy Problems – Tic-tac-toe problems, Missionaries and Cannibals Problem, Real World Problem – Travelling Salesman Problem

Unit-2
Basic introduction to stacks, queues, trees and graphs - General Search Algorithms – Searching for solutions – Problem-solving agents – Control Strategies – Uninformed Search Methods – Breadth First Search –Uniform Cost Search - Depth First Search -Depth Limited Search – Informed search - Generate and test - Best First search - A* Algorithm

Unit-3
Adversarial Search Methods (Game Theory) - Mini max algorithm - Alpha beta pruning - Constraint satisfactory problems – Constraints – Crypt Arithmetic Puzzles – Constraint Domain – CSP as a search problem (Room colouring).
Intelligent Agent – Rationality and Rational Agent – Performance Measures – Rationality and Performance – Flexibility and Intelligent Agents – Task environment and its properties – Types of agents.

Unit-4
Knowledge Representation – Knowledge based agents – The Wumpus world – Propositional Logic - syntax, semantics and knowledge base building - inferences – reasoning patterns in propositional logic – predicate logic – representing facts in logic: Syntax and semantics – Unification – Unification Algorithm - Knowledge representation using rules - Knowledge representation using semantic nets - Knowledge representation using frames inferences - Uncertain Knowledge and reasoning Methods.

Unit-5
Planning – planning problem – Simple planning agent – Blocks world problem – Mean Ends analysis
Learning - Machine learning - Learning concepts, methods and models
Introduction to expert system – architecture of expert systems.

Learning Resources	1. Parag Kulkarni, Prachi Joshi, Artificial Intelligence –Building Intelligent Systems, 1st ed., PHI learning, 2015 2. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition, Pearson Education, 2020.	3. Deepak Kemhani,First course in Artificial Intelligence,McGraw Hill Pvt Ltd, 2013 4. Data Structures Schaum's Outlines Series, Seymour, Lipschutz, 2014.

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA) - By the Course Faculty				By The CoE	
		Formative CLA-I Average of unit test (50%)		**Life Long* Learning** CLA-II- Practice (10%)		**Summative** Final Examination (40% weightage)	
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	10%	-	5%	-	5%	-
Level 2	Understand	10%	-	5%	-	10%	-
Level 3	Apply	10%	-	5%	-	10%	-
Level 4	Analyze	5%	-	-	-	10%	-
Level 5	Evaluate	10%	-	-	-	15%	-
Level 6	Create	-	-	-	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. Tejas Gowda, Co-Founder & Chief Data Scientist, TenzAI	Dr. T. Senthilkumar, Associate Professor, Amrita School of Engineering, Amrita Vishwa Vidyapeetham	Dr. A. Alice Nithya, SRMIST Dr. K. Senthil Kumar, SRMIST

Course Code	21CSC302J	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 :	Define the layered network architecture
CLR-2 :	Produce knowledge in IP addressing
CLR-3 :	Identify suitable routing algorithms based on geographical location of the devices
CLR-4 :	Apply the concept of Error detection to identify the errors in data.
CLR-5 :	Exploring reliable and unreliable protocols

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

Program Learning Outcomes (PLO)

	1 Engineering	2 Problem	3 Design &	4 Analysis,	5 Modern Tool	6 Society &	7 Environment &	8 Ethics	9 Individual	10 Communication	11 Project Mgt. &	12 Life Long	13 PSO - 1	14 PSO - 2	15 PSO – 3
CLO-1 : Apply the knowledge of communication	3	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CLO-2 : Construct the network using addressing schemes	3	-	-	2	-	-	-	-	-	-	-	-	-	-	-
CLO-3 : Design and implement the various Routing Protocols	3	-	-	2	3	-	-	-	-	-	-	-	-	-	-
CLO-4 : Identify and correct the errors in transmission	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-5 : Analyze the services provided by Transport and Application layers	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Unit-1

Introduction to Networks - Network Types : LAN, MAN, PAN, WAN - Network Topology : BUS, STAR, RING, MESH, HYBRID - Switching : Circuit Switching, Packet Switching - OSI Layered Architecture - TCP/IP Model - Physical Layer Overview - Latency, Bandwidth, Delay - Guided Media : Twisted pair, Coaxial cable, Fiber optic cable - Unguided Media : Radio waves, Microwaves, Infrared.

Lab 1: Introduction to Packet Tracer, Peer to Peer communication, study of cables and its colour codes

Lab 2: Implementation of Network Topologies

Lab 3: Router Configuration (Creating Passwords, Configuring Interfaces)

Unit-2

IPV4 Addressing - Address space - Classful addressing - Subnet mask - FLSM - Classless Addressing - VLSM – NAT – Super netting - Network Devices : Hub, Repeaters, Switch, Bridge, Router

Lab 4: IP addressing and Sub netting (VLSM)

Lab 5: Static and Default Routing

Lab 6: NAT Configuration

Unit-3

Forwarding of IP Packets — Static and Default Routing — Unicast Routing Algorithms: Distance Vector Routing, Link State Routing, Path Vector Routing — Protocols: RIP V1, RIP V2, OSPF, BGP, EIGRP — Multicasting Basics — IPV6 Addressing Basics

Lab 7: Implementation of RIP version 1

Lab 8: Implementation of RIP version 2

Lab 9: Implementation of Single Area OSPF

Unit-4

Medium Access Control : ALOHA ,CSMA/CD, CSMA/CA, Ethernet, Token Ring - Flow Control :Stop and Wait, Sliding Window - Error Control: Stop and Wait ARQ, Sliding Window ARQ - Error Detection : Parity Check, Checksum, CRC - Error Correction: Hamming codes - Data-Link Layer Protocols : HDLC, PPP.

Lab 10: Implementation of Multi Area OSPF

Lab 11: PPP Configuration

Lab 12: HDLC Configuration

Unit-5 Port Numbers — User Datagram Protocol — Transmission Control Protocol — WWW and HTTP — FTP — Email –Telnet – DNS. Lab 13: Implementation of BGP Lab 14: Implementation of EIGRP Lab 15: Telnet Configuration

Learning Resources	1. Behrouz A. Forouzan, "Data Communication 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

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA) - By the Course Faculty				By The CoE	
		Formative CLA-I Average of unit test (50%)		Life Long* Learning CLA-II- Practice (10%)		Summative Final Examination (40% weightage)	
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	-	20%	20%	-
Level 2	Understand	40%	-	-	40%	40%	-
Level 3	Apply	40%	-	-	40%	40%	-
Level 4	Analyze		-	-			-
Level 5	Evaluate	-	-	-			-
Level 6	Create	-	-	-	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. Srinivasan Varadharajan, Senior Principal Software Engineer, Manhattan Associates, Atlanta, United States	Dr. I.Joe Louis Paul, Associate Professor, SSN College of Engineering, TamilNadu	Dr. S. Metilda Florence, SRMIST

Course Code	21CSC303J	Course Name	Software Engineering and Project Management	Course Category		Engineering Sciences	L	T	P	C
							2	0	2	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 :	Illustrate the various techniques for requirements, planning and managing a technology project
CLR-3 :	Examine basic methodologies for software design, development, testing, and implementation
CLR-4 :	Understand manage users expectations and the software development team
CLR-5 :	Apply the project management and analysis principles to software project development

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 :	Identify the process of project life cycle model and process	3	-	-	-	-	-	-	-	-	-	2	-	-	-	-
CLO-2 :	Analyze and translate end-user requirements into system and software requirements	3	3	-	-	-	-	-	-	-	-	2	-	-	-	-
CLO-3 :	Identify and apply appropriate software architectures and patterns to carry out high level design of a system	3	-	2	-	-	-	-	-	-	-	2	-	-	-	-
CLO-4 :	Develop Test plans and incorporate suitable testing strategies	3	-	-	-	-	-	-	-	-	-	2	-	-	-	-
CLO-5 :	Examine the risk strategies and maintenance measures	3	-	-	-	-	-	-	-	-	-	3	-	-	-	-

Unit1: Introduction to Software Engineering: The evolving role of software, changing nature of software, Generic view of process: Software engineering- a layered technology, a process framework, Software Project Management - life cycle activities, Process models: The waterfall model, incremental process models, evolutionary process models, the unified process, Conventional- Agile, XP, Scrum, Project Initiation management – Project Charter, Project Scope, Project Objectives, Practical considerations.

Unit 2: Software Requirements: Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document. Requirements engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management, Software project effort and cost estimation – Cocomo model I, Cocomo Model II, LOC, Function point metrics

Unit 3: Software Design - Software Design Fundamentals, Design process – Design Concepts-Design Model– Design Heuristic , Design techniques– Architectural Design - Architectural styles, Creating an architectural design- software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams, Design of User Interface design Elements of good design, Design issues Features of modern GUI - Menus, Scroll bars, windows, Buttons, icons, panels, error Messages etc.

Unit 4: Software Construction-Coding Standards, Coding Frameworks. Reviews: Deskchecks, Walkthroughs, Code Reviews, Inspections, Coding Methods, Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging

Unit5: Product Release Management, Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan, Maintenance and Reengineering

Lab 1:Identify the Software Project, Create Business Case, Arrive at a Problem Statement
Lab 2:Analyse Stakeholder and User Description and Identify the appropriate Process Model
Lab 3:Identify the Requirements, System Requirements, Functional Requirements, Non-Functional Requirements and develop a SRS Document
Lab 4:Prepare Project Plan based on scope, Find Job roles and responsibilities, Calculate Project effort based on resources
Lab 5:Prepare the Work, Breakdown Structure based on timelines, Risk Identification and Plan
Lab 6:Design a System Architecture, Use Case Diagram, ER Diagram (Database)
Lab 7:DFD Diagram (process) (Upto Level 1), Class Diagram (Applied For OOPS based Project),
Lab 8: Interaction Diagrams, State chart and Activity Diagrams
Lab 9: State and Sequence Diagram, Deployment Diagram,
Lab 10: Sample Frontend Design (UI/UX)
Lab 11: Sample code implementation
Lab 12:Master Test Plan, Test Case Design (Phase 1
Lab 13:Manual Testing
Lab 14:User Manual, Analysis of Costing, Effort and Resource
Lab 15: Project Demo and Report Submission with the team

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

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA) - By the Course Faculty				By The CoE	
		Formative CLA-I Average of unit test (50%)		**Life Long* Learning** CLA-II- Practice (10%)		**Summative** Final Examination (40% weightage)	
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	**20%**	-	-	**20%**	**20%**	-
Level 2	Understand	**20%**	-	-	**20%**	**20%**	-
Level 3	Apply	**40%**	-	-	**40%**	**40%**	-
Level 4	Analyze	**20%**	-	-	**20%**	**20%**	-
Level 5	Evaluate	-	-	-			-
Level 6	Create	-	-	-	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. DHINAKAR JACOB SELWYN, CAP GEMINI TECHNNOLOGY		Mrs. Anupama C G
2. Mr. Girish Raghavan, Wipro Technologies		

Course Code	21CSC301T	Course Name	Formal Language and Automata	Course Category	C	Professional Core	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computing Technologies	*Data Book / Codes / Standards*	Nil		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	Construct automata for any equivalent regular expressions
CLR-2 :	Acquire brief knowledge about automata languages
CLR-3 :	Analyze about context free grammars and its implementation in Push down automata
CLR-4 :	Interpret the power of Turing machine and the decidable nature of a problem
CLR-5 :	Categorize undecidable problems and NP class problems

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and society	Environment &	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Summarize the basic concepts of deterministic and non-deterministic finite automata and its applications.	1	1		1		-	-	-	-	-	-	-	-	-	-
CO-2:	Analyze the formal relationships among machines, languages and Context free grammars and its normalization	3	3		3		-	-	-	-	-	-	-	-	-	-
CO-3:	Construct the Push down stack machine and its context free language acceptance and its equivalence with CFG	2	2		2	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Analyze the techniques for Turing machine construction and its recursive languages and functions	2	2		2	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Evaluate the computational complexity of various problems	3	3		3	-	-	-	-	-	-	-	-	-	-	-

Unit-1 : Finite Automata and Regular Expressions: Deterministic and Non-Deterministic Finite Automata, Finite Automata with ε-moves, regular expressions – equivalence of NFA and DFA, two-way finite automata, Moore and Mealy machines, Equivalence of Moore and Mealy machines, applications of finite automata.

Unit-2 : Regular Sets and Context Free Grammars: Properties of regular sets, context-Free Grammars and Languages – derivation trees, Simplification of CFG: Elimination of Useless Symbols Simplification of CFG: Unit productions, Null productions - Chomsky Normal Forms and Greibach Normal Forms, ambiguous and unambiguous grammars; minimization of finite automata

Unit-3: Pushdown Automata and Parsing Algorithms: Deterministic Push Down Automata – Non-Deterministic Push Down Automata – Equivalence of Pushdown Automata and context-free languages; Properties of CFL; Applications of pumping lemma –– closure properties of CFL and decision algorithms; Overview of Top-down parsing and Bottom-up parsing

Unit-4 : Turing machines: Turing machines (TM) – computable languages and functions – tuning machine constructions – storage in finite control – variations of TMs – Church-Turing thesis – Universal Turing machine– recursive and recursively enumerable languages

Unit-5: Introduction to Computational Complexity: Time and Space complexity of TMs – complexity classes – introduction to NP-Hardness and NP-Completeness Post Correspondence Problems (PCP) – Modified PCP – Halting Problems – Undecidability Problems

Learning Resources	Text Books: 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	Reference Books: 1. John.C.Martin, "Introduction to Languages and the Theory of Computation" McGraw-Hill Education, 01- May-2010. 2. Peter Linz , "An introduction to formal languages and automata", Jones & Bartlett Learning, Sixth Edition, 2017

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*15%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*20%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	*25%*	-	*30%*	-
Level 4	*Analyze*	*30%*	-	*25%*	-	*30%*	-
Level 5	*Evaluate*	-	-	*10%*	-	-	-
Level 6	*Create*	-	-	*5%*	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Santhosh Muniswami, Cisco Systems, Inc.	1. Dr. P. Victer Paul ,Indian Institute of Information Technology Kottayam	1. Dr. N. Arunachalam
2. B. Divya, TCS	2. Dr.C.Punitha Devi, Pondicherry University,	2. Dr. K. Vijaya

Course Code	21CSC304J	Course Name	COMPILER DESIGN	Course Category	C	Professional Core	L	T	P	C
							2	0	2	3

Pre-requisite Courses	21CSC301T	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department		Data Book / Codes / Standards			

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	Outline the implementation of Lexical Analyzer
CLR-2 :	To learn the various parsing techniques
CLR-3 :	Familiarize the intermediate code generation and run-time environment
CLR-4 :	To learn the implementation of code generator
CLR-5 :	Identify the various methods for Code Optimizer

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12			
		Engineering	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and	Environment &	Ethics	Individual & Team	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Acquire knowledge of Lexical Analyzer from a specification of a language's lexical rules	3	2	-	-	2	-	-	-	-	-	-	-	-	-	-
CO-2:	Apply different parsing algorithms to develop the parsers for a given grammar	3	3	-	-	2	-	-	-	-	-	-	-	-	-	-
CO-3:	Gain knowledge to translate a system into various intermediate codes	3	2	-	-	2	-	-	-	-	-	-	-	-	-	-
CO-4:	Analyze the methods of implementing a Code Generator for compilers	3	2	-	3	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Design the methods of developing a Code Optimizer	3	-	2	3	-	-	-	-	-	-	-	-	-	-	-

Unit-1 : Compilers-Phases of Compiler-Cousins of the Compiler-Grouping of Phases-Compiler construction tools- Lexical Analysis-Role of Lexical Analyzer-Input Buffering -Specification of Tokens -LEX -Finite Automata-Regular Expressions to Automata -Minimizing DFA.

Unit-2 : Role of Parser-Grammars-Error Handling-Context-Free Grammars-Writing a grammar- Elimination of Ambiguity-Left Recursion- Left Factoring-Top Down Parsing — Recursive Descent Parser- Predictive Parser-LL(1) Parser- Computation of FIRST-Computation of FOLLOW-Construction of a predictive parsing table-Predictive Parsers LL(1) Grammars- Predictive Parsing Algorithm- Problems related to Predictive Parser -Error Recovery in Predictive Parsing-.

Unit-3: Bottom Up Parsing-Reductions-Handle Pruning-Shift Reduce Parser-Problems related to Shift Reduce Parsing-Operator Precedence Parser, LEADING, TRAILING -LR Parser- LR Parsers- Need of LR Parsers-LR (0)Item-Closure of Item Sets- Construction of SLR Parsing Table -Problems related to SLR-Construction of Canonical LR(1)- Problems related to CLR - LALR Parser — Problems related to LALR-YACC.

Unit-4 : Intermediate Code Generation- prefix – postfix notation- Quadruple - triple - indirect triples Representation- Syntax tree- Evaluation of expression - Three-address code- Synthesized attributes – Inherited attributes - Intermediate languages – Declarations- Assignment Statements- Boolean Expressions- Case Statements- Back patching – Procedure calls- Code Generation- Issues in the design of code generator- The target machine – Runtime Storage management- A simple Code generator- Code Generation Algorithm- Register and Address Descriptors.

Unit-5: Code optimization -Principal Sources of Optimization- Function Preserving Transformation- Loop Optimization- Peephole optimization — DAG- Basic Blocks- Flow Graphs- Global Data Flow Analysis — Efficient Data Flow Algorithm- Runtime Environments- Source Language issues- Storage Organization- Activation Records- Storage Allocation strategies..

Lab 1 - Implementation of Lexical Analyzer
Lab 2 conversion from Regular Expression to NFA
Lab 3 Conversion from NFA to DFA
Lab 4 Elimation of Ambiguity, Left Recursion and Left Factoring
Lab 5 -FIRST AND FOLLOW computation

Lab 6 Predictive Parsing Table *Lab 7 - Shift Reduce Parsing* *Lab 8- Computation of LEADING AND TRAILING* *Lab9 Computation of LR(0) items* *Lab 10-Intermediate code generation – Postfix, Prefix* *Lab 11 Intermediate code generation – Quadruple, Triple, Indirect triple* *Lab 12 : A simple code Generator* *Lab 13 Implementation of DAG* *Lab 14 : Implementation of Global Data Flow Analysis* *Lab 15: Implement any one storage allocation strategies(heap, stack, static)*

Learning Resources	1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools, Second Edition, Pearson Education, 2011. 2. S. Godfrey Winster, S .Aruna Devi , R.Sujatha,"Compiler Design", Yesdee Publishing Pvt.Ltd, 2016. 3. K .Muneeswaran, "CompilerDesign", Oxford Higher Education, Fourth Edition, 2015. 4. David Galles, "Modern Compiler Design", Pearson Education, Reprit 2012. 5. Raghavan V., "Principles of CompilerDesign", Tata McGraw Hill Education Pvt. Ltd., 2010.	

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (45%)		*Life Long Learning CLA-2 – (15%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	-	*15%*	*15%*	-
Level 2	*Understand*	*25%*	-	-	*20%*	*25%*	-
Level 3	*Apply*	*30%*	-	-	*25%*	*30%*	-
Level 4	*Analyze*	*30%*	-	-	*25%*	*30%*	-
Level 5	*Evaluate*	-	-	-	*10%*	-	-
Level 6	*Create*	-	-	-	*5%*	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Saranya Baskar,Lead Software Testing Engineer, EPAM Systems India Private Limited, Hyderabad. saranya_baskar@epam.com	1.Dr. E. Ilavarasan, Professor, Department of Computer Science and Engineering, Puducherry Technological University, Puducherry.	1. Dr. M. Baskar, Associate Professor, Department of Computing Technologies, SRM Institute of Science and Technology, Kattankulathur.
	2. Dr. M. Shyamala Devi, Professor, Department of Computer Science and Engineering ,Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology, Chennai.	1. Dr. Godfrey Winster S, Associate Professor, Department of Computing Technologies, SRM Institute of Science and Technology, Kattankulathur.

Course Code	21CSC305P	Course Name	MACHINE LEARNING	Course Category	C	Professional Core	L	T	P	C
							2	1	0	3

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Explore the fundamental mathematical concepts of machine learning algorithms
CLR-2 :	Apply linear machine learning model to perform regression and classification
CLR-3 :	Utilize mixture models to group similar data items
CLR-4 :	Develop machine learning models for time –series data prediction
CLR-5 :	Design ensemble learning models using various machine learning algorithms

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design,	Modern Tool Usage	Society & Culture	Environment &	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CO-1 :	Understand the basics of machine learning using probability theory		2											1		
CO-2 :	Implement machine learning models using supervised learning algorithms		2		2											2
CO-3 :	Implement machine learning models using unsupervised learning algorithms		3		3											2
CO-4 :	Implement machine learning models for sequential data analysis and prediction		3		3											3
CO-5 :	Develop ensemble learning models for supervised and unsupervised learning		3		3											3

Unit1: Introduction : machine learning what and why?, supervised and unsupervised learning, polynomial curve fitting, probability theory- discrete random variables, fundamental rules,Bayes rule, Independence and conditional independence, continuous random variables, Quantiles, Mean and variance, probability densities, Expectation and covariance.

Practice:

1. Devise a program to import, load and view dataset

Create a program to display the summary and statistics of the dataset

Unit-2 Linear models for regression: Maximum likelihood estimation – least squares, robust linear expression, ridge regression, Bayesian linear regression. Linear models for classification: Discriminant function – Probabilistic generative models, Probabilistic discriminative models, Laplacian approximation, Bayesian logistic regression, Kernels functions, using kernels in GLMs, Kernel trick, SVMs.

Practice:

1. Implement linear regression to perform prediction

Implement Bayesian logistic regression and SVM for classification

Unit-3 Mixture models and EM: K-means clustering, mixtures of Gaussians, An alternative view of EM, Factor analysis, PCA, choosing the number of latent dimensions. Clustering – measuring dissimilarity, evaluating the output of clustering methods, Hierarchical clustering.

Practice:

1. Implement K-means clustering, mixtures of Gaussians and Hierarchical clustering algorithm to categorize data.
2. Create a program to perform PCA

Unit-4 Sequential data – Markov models, HMM – maximum likelihood for the HMM, The forward and Backward algorithm, the sum-product algorithm, scaling factors, Viterbi algorithm, linear dynamical systems.

Practice:

Implement HMM to predict the sequential data

Unit 5: Combining models – Bayesian model averaging, Boosting, Adaptive basis function models, CART, generalized additive models, Ensemble learning.

Practice:

1. Implement CART learning algorithms to perform categorization

Implement Ensemble learning models to perform classification

Learning Resources	1. Pattern Recognition and Machine Learning, Christopher M Bishop, Springer, 2006. 2. Machine Learning- A probabilistic perspective, Kevin P.Murphy, The MIT Press, 2012.	

Learning Assessment									
Bloom'sLevel of Thinking		Continuous Learning Assessment (CLA) - By the Course Faculty						By The CoE	
		CLA-1 Average of Unit test (20%)		CLA-2 Project Based Learning (60%)		Report and Viva Voce (20% Weightage)		Final Examination (0% weightage)	
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	-	15%		15%	-	-
Level 2	Understand	25%	-	-	20%		20%	-	-
Level 3	Apply	30%	-	-	25%		25%	-	-
Level 4	Analyze	30%	-	-	25%		25%	-	-
Level 5	Evaluate	-	-	-	10%		10%	-	-
Level 6	Create	-	-	-	5%		5%	-	-
Total		100 %		100 %		100 %		-	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr.Vaisakh. P.S, *Assistant executive manager, Samsung Electronics, Bangalore* *vaishakhps@samsung.com*	*Dr.C.Oswald, Assistanrt professor, NIT, Trichy,* *Oswald.mecse@gmail.com*	*A.Jackulin Mahariba, A.P/ CINTEL*

Course Code	21CSE253T	Course Name	Internet of Things	Course Category	E	Professional Elective	L	T	P	C
							2	1	0	3

Pre-requisite Courses	NIL	Co- requisite Courses	NIL	Progressive Courses	NIL
Course Offering Department	Computing Technologies	*Data Book / Codes / Standards*		NIL	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	Understand Smart Objects and IoT Architectures
CLR-2 :	Learn about various IOT-related protocols
CLR-3 :	Build simple IoT Systems using Arduino and Raspberry Pi.
CLR-4 :	Understand data analytics and cloud in the context of IoT
CLR-5 :	Develop IoT infrastructure for popular applications

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific outcomes		
		1 Engineering	2 Problem Analysis	3 Design/development of solutions	4 Conduct investigations of complex problems	5 Modern Tool Usage	6 The engineer and	7 Environment &	8 Ethics	9 Individual & Team	10 Communication	11 Project Mgt. & Finance	12 Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Explain the concept of IoT.	-1	-	-	-	-	2	-	-	-	-	-	-	-	-	-
CO-2:	Analyze various protocols for IoT.	-	-1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Design a PoC of an IoT system using Rasperry Pi/Arduino	2	-	*-1*	-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Apply data analytics and use cloud offerings related to IoT.	-	*3*	-	-	*-1*	-	-	-	-	-	-	-	-	-	-
CO-5:	Analyze applications of IoT in real time scenario	-	-1		*3*	-	-	-	-	-	-	-	-	-	-	-

Unit-1:FUNDAMENTALS OF IoT

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack –- Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

Unit-2:IoT PROTOCOLS

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

Unit-3: DESIGN AND DEVELOPMENT

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

Unit-4:DATA ANALYTICS AND SUPPORTING SERVICES

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG

Unit-5:CASE STUDIES/INDUSTRIAL APPLICATIONS

Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

Learning Resources	1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, —IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017 2. ArshdeepBahga, Vijay Madisetti, —Internet of Things – A hands-on approachll, Universities Press, 2015 3. Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and	

	Protocolsll, Wiley, 2012 (for Unit 2). 4. Jan Ho¨ ller, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014. 5. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Thingsll, Springer, 2011. 6. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.	

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*15%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*20%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	*25%*	-	*30%*	-
Level 4	*Analyze*	*30%*	-	*25%*	-	*30%*	-
Level 5	*Evaluate*	-	-	*10%*	-	-	-
Level 6	*Create*	-	-	*5%*	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.Shreyas Lakshminarayanan, Systems Engineer *Tata Consultancy Services Pvt Ltd, Chennai*	*1. Dr. G.R. Sakthidharan, Professor/GRIET, Hyderabad*	*1. M. Arulprakash, Assistant Prof./CTech/SRMIST*
2. Shaishav Tayde, IT Analyst *Tata Consultancy Services Pvt Ltd, Ahmedabad*	*3. Dr. Arunraj, Associate Prof./Crescent University, Chennai*	*2. J. Ramapraba, Assistant Prof./CTech/SRMIST*

Course Code	21CSE254T	Course Name	Bio Inspired Computing	Course Category	E	Professional Elective	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computing Technologies	*Data Book / Codes / Standards*		Nil	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	Understand the basics of biological systems
CLR-2 :	Acquire knowledge on working of Evolutionary algorithms
CLR-3 :	Gain the knowledge on the fundamentals and topological working of Artificial Neural Networks
CLR-4 :	Conceive the the fundamentals and working of Swarm Intelligence
CLR-5 :	Explore the working of Immuno Computing Techniques

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific outcomes		
		1 Engineering	2 Problem Analysis	3 Design/development of solutions	4 Conduct investigations of complex problems	5 Modern Tool Usage	6 The engineer and	7 Environment &	8 Ethics	9 Individual & Team	10 Communication	11 Project Mgt. & Finance	12 Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Exhibit knowledge on fundamental concepts of bio inspired computing	3	2	-	2	-	-	-	-	-	-	-	-	-	3	2
CO-2:	Apply evolutionary algorithms and perform computing	2	2	-	-	-	-	-	-	-	-	-	-	-	3	2
CO-3:	Design and develop simple neural network models	3	-	3	2	-	-	-	-	-	-	-	-	-	3	2
CO-4:	Recommend appropriate swarm algorithm for building an AI model	2	2	2	-	-	-	-	-	-	-	-	-	-	3	2
CO-5:	Apply suitable Immuno Computing algorithm for a given problem	2	-	2	-	-	-	-	-	-	-	-	-	-	3	2-

Unit-1 : INTRODUCTION

Models of Life and Intelligence - Fundamentals of bio-inspired models and bio-inspired computing. Evolutionary models and techniques, Swarm models and its self-Organization, swarm and evolutionary algorithms. Optimization problems – single and multi-objective optimization, heuristic, meta-heuristic and hyper heuristic functions

Unit-2 : : EVOLUTIONARY COMPUTING

Evolutionary Computing, Hill Climbing and Simulated Annealing, Darwin's Dangerous Idea, Genetics Principles, Standard Evolutionary Algorithm -Genetic Algorithms, Reproduction-Crossover, Mutation, Evolutionary Programming, Genetic Programming

Unit-3: NEURAL MODELS

Biological nervous systems, artificial neural networks, evolution of neural networks,neuron models, architecture, unsupervised learning, supervised learning, reinforcement learning,Linear separability problem,signal encoding, synaptic plasticity, hybrid neural systems

Unit-4 : SWARM INTELLIGENCE

Introduction - Ant Colonies, Ant Foraging Behavior, Ant Colony Optimization, SACO and scope of ACO algorithms, Ant Colony Algorithm (ACA), Swarm Robotics, Foraging for food, Social Adaptation of Knowledge, Particle Swarm Optimization (PSO)

Unit-5: IMMUNO COMPUTING SYSTEMS

Introduction- Immune System, Physiology and main components, Pattern Recognition and Binding, biological immune systems, lessons for artificial immune systems, algorithms and applications, shape space, negative selection algorithm, clonal selection algorithm, Bone Marrow Models, Forest's Algorithm

Learning Resources

1. Leandro Nunes de Castro - " Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007
2. Floreano, D. and C. Mattiussi -"Bio-Inspired Artificial Intelligence: Theoriesethods, and Technologies"IT Press, 2008
3. Albert Y.Zomaya - "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006
4. Marco Dorrigo, Thomas Stutzle -" Ant Colony Optimization", Prentice Hall of India, New Delhi, 2005
5. D. E. Goldberg, "Genetic algorithms in search, optimization, and machine learning", Addison- Wesley, 1989.
6. Simon O. Haykin, "Neural Networks and Learning Machines", Third Edition, Prentice Hall, 2008.

Learning Assessment							
	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*15%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*25%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	30%	-	*30%*	-
Level 4	*Analyze*	*30%*	-	30%	-	*30%*	-
Level 5	*Evaluate*	-	-	-	-	-	-
Level 6	*Create*	-	-	-	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Muthukumarasamy S, Capgemini India Pvt Ltd,Chennai	*1. . Deivamani Mallaya, College of Engineering, Guindy, Chennai.*	*1.* Ms.S.Kiruthika devi, SRMIST
		2. Dr. K. Deeba, SRMIST

Course Code	21CSE255T	Course Name	Computer Graphics and Animation	Course Category	E	Professional Elective	L	T	P	C
							2	1	0	3

Pre-requisite Courses		Co- requisite Courses	NIL	Progressive Courses	NIL
Course Offering Department	Computing Technologies	*Data Book / Codes / Standards*	NIL		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	Identify various computer graphics drawing algorithms
CLR-2 :	Provide understanding of 2D transformations and viewing methods
CLR-3 :	Learn 3D transformations and viewing methods
CLR-4 :	Explore Visible surface detection methods
CLR-5 :	Acquire the knowledge of animation and image processing methods

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and [illegible]	Environment & [illegible]	Ethics	Individual & Team [illegible]	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Accrue the basic knowledge of computer graphics and various algorithms	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO-2:	Implement 2D transformations and viewing methods	3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO-3:	Demonstrate various 3D transformations and viewing methods	3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO-4:	Apply various visible surface detection methods	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO-5:	Develop various computer animations	3		3	-	2	-	-	-	-	-	-	-	-	3	2

Unit-1 : Introduction to Computer Graphics
Overview of Computer Graphics, Computer Graphics Application and Software - Video Display devices - Raster scan systems - Random Scan systems - Graphics Monitors and Workstations - Input Devices - Hard-Copy Devices - Graphics Software - Output Primitives - Points and Lines - Line-Drawing Algorithms - Circle-Generating Algorithms - Ellipse-Generating Algorithms - Parallel Curve Algorithms - Curve Functions -Pixel Addressing - Filled-Area Primitives - Scan-Line Polygon Fill Algorithm Inside-Outside Tests Scan -Line Fill of Curved Boundary Areas - Boundary-Fill Algorithm - Flood-Fill Algorithm - Overview of various attributes

Unit-2 : 2D Transformations
Introduction to 2D transformations
Basic transformations - Matrix representations - Composite Transformations -Transformations - Shear- Affine- Reflection - 2D viewing - The Viewing Pipeline-viewing functions - Clipping operations - Point clipping - Line Clipping -Cohen-Sutherland -Liang-Barsky- Nicholl-Lee-Nicholl - Line Clipping Using Nonrectangular Clip Windows - Splitting Concave Polygons - Polygon Clipping - Other Clipping methods

Unit-3: 3D Transformations
Introduction to 3D transformations
Translations - Rotations - Reflections- shearing - Scaling - other transformations - Matrix Representation of 3D Transformations - 3D Viewing - Viewing Pipeline- Coordinates - Projections -Parallel- Perspective -View Volumes and General Projection Transformations-General Parallel-Projection Transformations- Clipping-Hardware Implementations Three-Dimensional Viewing-Functions

Unit-4 : Visible-Surface Detection Methods
Introduction- Classification of Visible-Surface Detection Algorithms -Back-Face Detection-Depth-Buffer Method-Buffer Methods-Scan-Line Method-Depth-Sorting Method
BSP-Tree Method-Area-Subdivision Method-Octree Methods

Ray-Casting Method-Curved Surfaces-Wireframe Methods-Visibility-Detection Functions- Ilumination Models and Surface-Rendering Methods-Light Sources Basic Illumination Models-Displaying Light Intensities-Halftone Patterns and Dithering Techniques -Polygon-Rendering Methods-Ray-Tracing Methods -comparison of the methods.
Unit-5: Computer Animation and Color Models Principles of Animation, Key framing, Deformations- Motion Specifications S3- Color models - Properties of light- types - Color model conversion - applications - Mathematics for computer Graphics - Coordinate-Reference Frames-Points and Vectors - Basis Vectors and the Metric Tensor- Matrices - Digital Image- File formats - Compression standard - JPEG- Enhancement and Constrast stretching- Practices on open source image processing software[

Learning Resources	1. Donald Hearn and Pauline Baker M, ―Computer Graphics", Prentice Hall, 2nd Edition, New Delhi, 2007 2. Fundamentals of Computer Graphics by Steve Marschner and Peter Shirley, 4th Edition, A K Peters/CRC Press, 2018 ISBN: 9781315360201	3. Computer Graphics Principles and Practice Third Edition by JOHN F. HUGHES, ANDRIES VAN DAM, MORGAN MCGUIRE, DAVID F. SKLAR, JAMES D. FOLEY, STEVEN K. FEINER KURT AKELEY, Addison- Wesley, 3rd Edition, 2008 4.Andleigh, P. K and Kiran Thakrar, ―Multimedia Systems and Design, PEARSON EDUCATION, 2015

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*15%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*25%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	30%	-	*30%*	-
Level 4	*Analyze*	*30%*	-	30%	-	*30%*	-
Level 5	*Evaluate*	-	-	-	-	-	-
Level 6	*Create*	-	-	-	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. N. Madhu, Senior Analyst, Tata Elexsi,Siruseri.	1. Dr. N. Brindha, Associate Professor, Department of Computer Science and Engineering, NIT, Trichy	1. Dr. P. Murali, Associate Professor, Department of Computing Technologies, School of computing, SRMIST, Kattankulathur
	2. Dr. Asha, Associate Professor, Department of Computer Science and Engineering, VIT, Chennai 3.	2.

Course Code	21CSE351T	Course Name	Computational Logic	Course Category	E	Professional Elective	L	T	P	C
							2	1	0	3

Pre-requisite Courses	NIL	Co- requisite Courses	NIL	Progressive Courses	NIL
Course Offering Department	CTECH	Data Book / Codes / Standards	NIL		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Explore the basics of Propositional logic
CLR-2 :	Provide skills on rules to handle Propositional logic and various deduction rules
CLR-3 :	Learn the First order Logic and its applications
CLR-4 :	Aquire the art of .applying various inference rules in First Order Logic
CLR-5 :	Introduce Modal logic and its Inference rules

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO) 1 Engineering Knowledge	2 Problem Analysis	3 Design/development of solutions	4 Conduct investigations of complex problems	5 Modern Tool Usage	6 The engineer and society	7 Environment & Sustainability	8 Ethics	9 Individual & Team Work	10 Communication	11 Project Mgt. & Finance	12 Life Long Learning	Program Specific outcomes PSO-1	PSO-2	PSO-3
CO-1:	Apply the skills acquired on propositional logic to solve examples at hand	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Analyze the rules learnt towards problem solving	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Acquire mastery over FOL and Meta theorems and apply the same with confidence	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Distinguish the acquired knowledge on AI under appropriate problem solving contexts	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Attempt to apply the acquired knowledge on modal logics under appropriate problem solving contexts	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-

Unit-1 : Propositional Logic-Introduction-Syntax of PL-Is It a Proposition?- Interpretations-Models-Interpretations-Equivalences and Consequences-More About Consequence-A Propositional Calculus-Axiomatic System PC-Five Theorems about PC-Using the Metatheorems-Adequacy of PC to PL-Compactness of PL

Unit-2 : Normal Forms and Resolution-Truth Functions-CNF and DNF-Logic Gates-Satisfiability Problem-Resolution in PL-Resolution Strategies-Other Proof Systems for PL-Natural Deduction-Gentzen Sequent Calculus-Analytic Tableaux

Unit-3: First Order Logic-Syntax of FL-Scope and Binding-Substitutions-Semantics of FL-Translating into FL-Satisfiability and Validity-Some Metatheorems-A First Order Calculus-Axiomatic System FC-Six Theorems about FC-Adequacy of FC to FL-Compactness of FL

Unit-4 : First Order Logic-Syntax of FL-Scope and Binding-Substitutions-Semantics of FL-Translating into FL-Satisfiability and Validity-Some Metatheorems-A First Order Calculus-Axiomatic System FC-Six Theorems about FC-Adequacy of FC to FL-Compactness of FL

Unit-5: Modal Logic K—Introduction-Syntax and Semantics of K-Validity and Consequence in K-Axiomatic System KC-Adequacy of KC to K-Natural Deduction in K-Analytic Tableau for K-Other Modal Logics-Various Modalities-Computation Tree Logic

Learning Resources	1. 1. Arindama Singh,"Logics for Computer Science", PHI Learning Private Ltd,2nd Edition,2018 2. 2. Wasilewska & Anita,"Logics for computer science: classical and non-classical",Springer ,2018 3. 3. Huth M and Ryan M ,ll Logic in Computer Science : Modeling and Reasoning about 1. systemsll,Cambridge University Press, 2005	4. 4. Dana Richards & Henry Hamburger,"Logic And Language Models For Computer Science",Third 5. Edition,World Scientific Publishing Co. Pte. Ltd,2018. 6. 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 (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 – (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
	1. Dr.Masilamani , IITKD Kancheepuram	1. Dr.K.Senthil Kumar, CTech, SRMIST
	2. Dr.G.Venkiteswaran, BITS Pilani	2.

Course Code	21CSE352T	Course Name	NEURO FUZZY AND GENETIC PROGRAMMING	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							2	1	0	3

Pre-requisite Courses	NIL	Co- requisite Courses	NIL	Progressive Courses	NIL
Course Offering Department	COMPUTING TECHNOLOGIES	Data Book / Codes / Standards	NIL		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understand the core concepts and architectures of Neural Networks
CLR-2 :	Recognize Associative Memory and Adaptive Resonance Theory in Neural Networks
CLR-3 :	Articulate the fundamentals and various models of Fuzzy Systems
CLR-4 :	Illustrate the concepts of Genetic Algorithms
CLR-5 :	Integrate Neural Network, Fuzzy Logic and Genetic Algorithm techniques

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)												Program Specific outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and society	Environment &	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Apply the concepts of Neural Network for building intelligent systems	2-	3-	-	-	2-	-	-	-	-	-	-	-	-	2	-
CO-2:	Correlate Associative Memory and Adaptive Resonance Theory in Neural Networks	-2	-3	-	-	-2	-	-	-	-	-	-	-	-	2	-
CO-3:	Devise a framework for building Fuzzy Logic Systems	-1	-3	-	-	-3	-	-	-	-	-	-	-	-	2	-
CO-4:	Examine the modelling of Genetic Algorithms	-1	-3	-	-	-3	-	-	-	-	-	-	-	-	2	-
CO-5:	Apply the concepts of Neural Network, Fuzzy Logic and Genetic Algorithm for developing a framework for hybrid systems	-3	-3	-	-	-3	-	-	-	-	-	-	-	-	2-	-

Unit-1 : NEURAL NETWORKS

Introduction to Artificial Intelligence Systems, Fundamentals of Neural Networks- Basic concepts, Human brain, Model of an Artificial Neuron, Neural Network Architectures, Characteristics of Neural Networks, Learning Methods, Taxonomy of Neural Network Architectures, History of Neural Network Research, Early Neural Network Architectures, McCulloch-Pitts Neuron Model; Back Propagation Networks - Architecture, Backpropagation Learning, Illustration, Applications, Effect of Turning Parameters of the Backpropagation Neural Network, Selection of various parameters in BPN, Variations of Standard Backpropagation Algorithms; Practice of Neural Network Tool - XOR Problem

Unit-2 : ASSOCIATIVE MEMORY & ADAPTIVE RESONANCE THEORY

Associative Memory - Autocorrelators, Heterocorrelators, Wang et al.'s Multiple Training Encoding Strategy, Exponential BAM, Associative Memory for Real-coded Pattern Paris, Applications; Adaptive Resonance Theory - Introduction, ART1, ART2, Applications, Sensitivities of Ordering of Data; Practice of Neural Network Tool- Delta Rule

Unit-3: FUZZY LOGIC

Fuzzification; Fuzzy Set Theory- Fuzzy versus Crisp, Crisp Sets, Fuzzy Sets, Crisp Relations, Fuzzy Relations; Fuzzy Systems- Crisp Logic, Predicate Logic, Fuzzy Logic, Fuzzy Rule Based System, Defuzzification Methods, Practice of Fuzzy Logic Tool- Fuzzy Functions

Unit-4 : GENETIC ALGORITHMS

Genetic Algorithms- Basic Concepts, Creation of Offspring, Working Principle, Encoding, Fitness Function, Reproduction; Genetic Modelling - Inheritance Operators, Crossover, Inversion and Deletion, Mutation Operator, Bitwise Operators used in GA, Generation Cycle, Conversion of Genetic Algorithm, Applications, Multilevel Optimization, Advances in GA, Practice of Optimization in Genetic Algorithm Tool

Unit-5: HYBRID SYSTEMS

Introduction, Neural Networks, Fuzzy Logic and Genetic Algorithms Hybrids; Genetic Algorithm based Back Propagation Networks - GA Based Weight Determination; Fuzzy Backpropagation Networks- LR Type Fuzzy Numbers, Fuzzy Neuron, Fuzzy BP Architecture, Learning in Fuzzy BP; Fuzzy Logic Controlled Genetic Algorithms- GA in Fuzzy Logic Controller Design, Fuzzy Logic Controller, FLC-GA Based Structural Optimization.

Learning Resources	1. S. Rajasekaran, G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic, and Genetic Algorithms, Synthesis and Applications", PHI Learning Private Limited, 15th Printing, 2011. 2. S. Rajasekaran, G. A. Vijayalakshmi Pai,"Neural Networks, Fuzzy Systems and Evolutionary Algorithms" PHI Learning Private Limited, Second Edition, 2017. 3. L. Fortuna, G. Rizotto, M. Lavorgna, G. Nunnari, M. G. Xibilia, and R. Caponetto, "Soft Computing, New Trends and Applications", Springer, 2001.	4. S. N. Sivanandam, S. N. Deepa, "Principles of Soft Computing", Wiley, 3rd edition. 5. Dilip K. Prathihar, "Soft Computing - Fundamentals and Applications", Alpha Science International Limited, 2014. 6. Simon Hawkins, "Neural Networks", Pearson Education, 3rd edition, 2008. 7. Lone, Y. A., Singh, H. (2019). Deep Neuro-Fuzzy Systems with Python: With Case Studies and Applications from the Industry. Germany: Apress.

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 – (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	25%	-	25%	-
Level 3	Apply	30%	-	30%	-	30%	-
Level 4	Analyze	30%	-	30%	-	30%	-
Level 5	Evaluate	-	-		-	-	-
Level 6	Create	-	-		-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Vinay Ramanath, Principal Key Expert Scientist,Simulations and Digital Twins Siemens Technology.	1. Dr. Y. Nancy Jane, Assistant Professor, Madras Institute of Technology, Anna University.	1. Dr. Sindhuja M, Assistant Professor
2. Prabakaran, Aerothermal Engineer - India Defence Rolls Royce India Pvt Ltd.		

Course Code	21CSE353T	Course Name	Augmented, Virtual and Mixed Reality	Course Category	E	Professional Elective	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nill	Progressive Courses	Nil
Course Offering Department	Computing Technologies	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understand the overview concepts of Augmented, Virtual and Mixed Realties
CLR-2 :	Apply the concepts to develop unreal scenarios and components
CLR-3 :	Practical understanding of concepts of Unity software
CLR-4 :	Apply AR concepts to develop unreal use cases
CLR-5 :	Apply VR concepts to develop unreal use cases
CLR-6 :	Develop UI model using Oculus Quest with underlying concepts and create VR apps

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)												Program Specific outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and society	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Describe the similarities and differences between the Mixed Reality Technologies	3	-	2	-	-	-	-	-	-	-	-	-	-	-	2
CO-2:	Demonstrate the applications of AR technologies	3	-	2	-	-	-	-	-	-	-	-	-	-	-	2
CO-3:	Apply the framework for AR applications	-	-	3	-	2	-	-	-	-	-	-	-	-	-	2
CO-4:	Demonstrate the applications of VR technologies	-	-	3	-	2	-	-	-	-	-	-	-	-	-	2
CO-5:	Apply the framework for VR applications	-	-	3	-	2	-	-	-	-	-	-	-	-	-	2
CO-6:	Create the user interface for VR applications	-	-	3	-	2	-	-	2	-	-	-	-	-	-	2

Unit-1 : VR, AR, MR, xR: similarities and differences, Current trends, and state of the art in immersive technologies, The future of human experience - Human Perception and Cognition, Technology on Stereoscopic Display: Immersion and Presence, Developing platforms and consumer devices, Physiology, Psychology and the Human Experience, Adaptation and Artefacts, Ergonomics, Ethics, Guidelines for Proper VR Usage, User-Centered Design, User Experience: Scientific Concerns, VR Health and Safety Issues, Effects of VR Simulations on Users, Cyber sickness, before and now, Ethical Code of Conduct.

Unit-2 : AR components and techniques, AR Frameworks, Practical understanding of real world AR application development, AR methodologies and project types,VR components and techniques, VR frameworks, Practical Understanding of real world VR application development, VR methodologies and project types, Navigation and Manipulation Interface techniques in Blender

Unit-3: AR advanced SDKs, AR core & Kit, AR spark studio, Vuforia engine, perform preliminary data quality and formatting, Hands on Unity Software and Use case applications, Purpose of Wikitude and 8th wall tools

Unit-4 : Specific aspects of Unreal engine, Unreal engine vs unity, Unreal/Unity engine Physics & optimization techniques, Application demos, The present and the future of MR/xR :

Unit-5: Modeling the Physical world: Geometric Modeling- Kinematics Modeling- Physical Modeling-, Locomotion tools, Oculus setup and environment for object interaction, User Interface/Experience developed through Oculus Quest – Audio/video in Immersive Environments, Introduction to Metaverse and applications, Behavior Modeling the functionalities of Metaverse applications through a Real-World Example

Learning Resources	1. David Rose,"Super sight: What Augmented Reality Means for our lives, our work, and the way we imagine our future", Nov 2021 2. Lily Sayter, Brain Solis, The augmented Workforce, 2020 3. Hevin W Allen, Meta Verse- A beginners guide to the new digital revolution	4. Jonathan Linowes, "Augmented Reality with Unity AR Foundation- a practical guide to cross platform AR development with Unity and later versions, 2021 5. Kenneth J.Varnum, Beyond Reality- Augmented Virtual and Mixed Reality in the library, 2020

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 – (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr.Jagatheeswaran Senthilvelan, Head - IoT and Robotics, Auxo Labs	Prof Thuong Hoang Associate Head of School, Research Faculty of Sci Eng & Built Env School of Info Technology Deakin University,Melbourne Burwood Campus, Australia	1. Dr.M.Pushpalatha, Professor
Mr.Gowtham, Head - Innovation and Technology, ProtoHubs.io		2. Dr.Vaishnavi Moorthy, Assistant Professor

Course Code	21CSE354T	Course Name	Full Stack Web Development	Course Category	E	Professional Elective	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computing Technologies	Data Book / Codes / Standards			

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	To Introduce the Web Fundamentals
CLR-2 :	To Introduce the Client-side scripting with reac.js
CLR-3 :	To Introduce the Database Connectivity
CLR-4 :	To Introduce the Spring Framework with Basic Concepts
CLR-5 :	To Introduce the Spring Boot and Micro-Services

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO) 1 Engineering Knowledge	2 Problem Analysis	3 Design/development of solutions	4 Conduct investigations of complex problems	5 Modern Tool Usage	6 The engineer and society	7 Environment &	8 Ethics	9 Individual & Team Work	10 Communication	11 Project Mgt. & Finance	12 Life Long Learning	Program Specific outcomes PSO-1	PSO-2	PSO-3
CO-1:	Ability to understand the Static Web Page Application	3	2	2	-	-	-	-	-	-	-	-	-	2	-	-
CO-2:	Ability to apply scripting at client side.	3	2	2	-	-	-	-	-	-	-	-	-	2	-	-
CO-3:	Ability to connect with Database to do CRUD operations.	3	2	2	-	-	-	-	-	-	-	-	-	2	-	-
CO-4:	Ability to Develop, Maintain and applications using Spring Boot Framework.	3	2	3	-	-	-	-	-	-	-	-	-	2	-	-
CO-5:	Ability to use Microservices	3	2	2	-	-	-	-	-	-	-	-	-	2	-	-

Unit-1 : HTML ,CSS Overview

HTML Overview: Structuring an HTML Document, Validating and debugging your code, Working with Fonts, Text Blocks, Lists and Tables, Using External and Internal Links, Working with Colors, Images, and Multimedia.
CSS Overview: Understanding Cascading Style Sheets, Working with Margins, Padding, Alignment and Floating, Understanding the CSS Box Model and Positioning, Using CSS to do more with Lists, Text, and Navigation, Creating Layouts Using modern CSS Techniques, Taking Control of Backgrounds and Borders, Using CSS Transformations and Transitions, Animating with CSS and the Canvas.

Unit-2 : JavaScript ,React JS Overview

JavaScript Overview: Understanding JavaScript, Understanding Dynamic Websites and HTML5 Applications, Getting Started with JavaScript Programming, working with the Document Object Model (DOM), Using JavaScript Variables, Strings, and Arrays, Controlling Flow with Conditions and Loops, Responding to Events and Using Windows, JavaScript Best Practices., Using Third-Party JavaScript Libraries and Frameworks.
React JS: The Foundation of React, JSX, All About Components of React, Events, Forms, Refs, Styling React, Routing, Hooks: Rules of Hooks, The Built-in Hooks (useState, useEffect, useContext, useMemo, useRef), Writing Custom Hooks, Labeling Custom Hooks with useDebugValue, Finding and Using Custom Hooks.

Unit-3: SQL ,JDBC Overview

SQL Overview: Basics of SQL: Data basics, Retrieval: Basic Selection, Joins, Set Queries: UNION, INTERSECT, and EXCEPT, Subqueries, Modifying Data: Insert, Delete, Update, Creating, Deleting, and Altering Tables,
JDBC: Introduction to JDBC: Setting up the database, connecting to a Database: The Connection Interface, connecting to the database using Driver Manager, Querying and Updating the Database: Statement Interface, Result Set Interface, Querying and Updating the Database.

Unit-4 : Spring Boot Framework-Part-1

Spring Boot Framework-Part-1: Basic concepts: Spring, Spring Boot, Testing Basics, Testing in Spring Boot. A Basic Spring Boot Application: Setting up the Development Environment, The Skeleton Web App, Spring Boot Auto configuration, Three-Tier, Three-Layer Architecture, Modeling our Domain, Business Logic, Presentation Layer.

Unit-5: Spring Boot Framework-Part-2

Spring Boot Framework-Part-2: The Data Layer: The Data Model, choosing a Database, Spring Boot Data JPA, Entities, Repositories, Storing Users and Attempts. Microservices: Moving to Microservices, Architecture Overview, Designing and Implementing the New Service, User Interface UI

Learning Resources	1. Sams Teach Yourself HTML, CSS, and JavaScript All in One, Julie Meloni, First Edition 2019, Pearson. (Unit - I, Unit - II) 2. BEGINNING ReactJS Foundations Building User Interfaces with ReactJS: AN APPROACHABLE GUIDE, Chris Minnick, First Edition 2022, Published by John Wiley & Sons. (Unit - II) 3. SQL Practical Guide for Developers, Michael J. Donahoo & Gregory D. Speegle, 2005, Morgan Kaufmann Publishers an Imprint of Elsevier. (Unit - III) 4. Oracle Certi¬fied Professional JavaSE 8 Programmer, Exam 1Z0-809 A Comprehensive OCPJP 8 Certi-fication Guide, by S G Ganesh, Hari Kiran & Tushar Sharma, 2016, APress publisher. (Unit – III) 5. Learn Microservices with Spring Boot: A Practical Approach to RESTful Services Using an Event-Driven Architecture, Cloud-Native Patterns, and Containerization, Moisés Macero García, Second Edition – 2020, APress Publisher.	6. Programming the World Wide Web, by Robert W. Sebesta, Eighth Edition - 2014, Published by Pearson. 7. Internet and World Wide Web How To Program, Paul Deitel, Harvey Deitel, and Abbey Deitel, Fifth Edition - 2011, Published by Prentice Hall. 8. Database Programming with JDBC and Java, by George Reese, Second Edition - 2000, Published by O'Reilly Media. 9 Expert Oracle JDBC Programming, by R. M. Menon,First Edition - 2005, Published by Apress. 10. Pro Spring MVC with WebFlux: Web Development in Spring Framework 5 and Spring Boot 2, by Marten Deinum and Iuliana Cosmina, Second Edition - 2022, Published by Apress. 11 Full stack development with Spring Boot and React: build modern and scalable full stack applications using the power of Spring Boot and React, by Juha Hinkula, Third Edition - 2022, Published by 12. Spring Boot in Practice, Somnath Musib, First Edition - 2022, Manning Publications.

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 – (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
	1.	1. Mr.Suresh Anand
	2.	2. Ms. N.Anbarasi

Course Code	21CSE355T	Course Name	Data Mining and Analytics	Course Category	E	Professional Elective	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	COMPUTING TECHNOLOGIES	Data Book / Codes / Standards			

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Introduce the basic concepts of pattern discovery and data preparation
CLR-2 :	Understand the importance of Association and Correlation Algorithms
CLR-3 :	Comprehend and apply various Classifiers
CLR-4 :	Work with the foundation for Clustering
CLR-5 :	Perform Outlier Analysis and Explore a data mining tool

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)												Program Specific outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and society	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Do the preprocessing of data before mining of data for patterns	-1	2-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Make use of Association and Correlations Algorithms for framing association rules	-1	-2	-	-	-3	-	-	-	-	-	-	-	-	-	-
CO-3:	Apply as well as Compare the performance of various classifiers	-1	2-	-	-	3-	-	-	-	-	-	-	-	-	-	-
CO-4:	Utilize different Clustering algorithms for generalization	-1	2-	-	-	3-	-	-	-	-	-	-	-	-	-	-
CO-5:	Identify Outliers in the data given	-1	-2	-	-	3-	-	-	-	-	-	-	-	-	-	-

Unit-1 : DATA MINING INTRODUCTION

Introduction: Kinds of Data- Kinds of Patterns-Data Objects and Attribute Type- Data Visualization -Data Preprocessing: Data cleaning, Data Integration, Data Transformation,Data Discretization and Data Reduction: Attribute Subset Selection-Histograms, Clustering, Sampling

Unit-2 : ASSOCIATIONS AND CORRELATIONS

. Market Basket Analysis – Apriori Algorithm – Mining Frequent Itemsets without Candidate Generation – Mining Frequent Itemsets Using Vertical Data Format – Mining Closed Frequent Itemsets – Mining Multilevel Association Rules – Mining Multidimensional Association Rules – Correlation Analysis – Constraint-Based Association Mining

Unit-3: CLASSIFICATION AND PREDICTION

Basic Concepts- Decision Tree Induction-Attribute selection Measures-ID3 and CART algorithms, Tree Pruning-Bayes Classification Methods: Bayes" Theorem, Naive Bayesian Classification - Classification by Backpropagation- Support Vector Machines-Lazy learners: KNN-Metrics for evaluating classifier performance-Techniques to improve classification accuracy-Prediction: Regression Analysis

Unit-4 : CLUSTER ANALYSIS

Cluster Analysis: Partitioning Methods- Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering-Probabilistic Model based Clustering - BIRCH, DBSCAN, STING,CLIQUE Techniques- Evaluation of clustering Techniques

Unit-5:OUTLIERS AND STATISTICAL APPROACHES IN DATA MINING

Introduction to outliers, Challenges in detecting Outliers,Outlier Detection Methods - Supervised, Semisupervised, Unsupervised- Statistical Data Mining approaches - Data mining in Recommender Systems,Data mining for Intrusion Detection, Data Mining for Financial Analysis

Learning Resources	1. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012	Ian H. Witten, Eibe Frank and Mark A. Hall "Data Mining: Practical Machine Learning Tools and Techniques", Fourth Edition, Elsevier,2017.

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 – (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr. T. Ruso,Senior Project Lead, HCL Technologies, Chennai	1. Khanna Nehemiah, Associate Professor, Anna University Chennai	1.
	2.	2.

Course Code	21CSE356T	Course Name	Natural Language Processing	Course Category	E	Professional Elective	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computing Technologies	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understand the fundamentals behind the Language processing and perform word level analysis.
CLR-2 :	Understand the syntactic processing and probabilistic context-free grammars.
CLR-3 :	Conceive the basics of the knowledge representation, inference, and discourse analysis.
CLR-4 :	Recognize the significance of transformer based models.
CLR-5 :	Understand the natural language processing applications and to learn how to apply basic algorithms in this field.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)												Program Specific outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of	Modern Tool Usage	The engineer and society	Environment &	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Exhibit knowledge on text preprocessing techniques and perform word level analysis.	3	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO-2:	Illustrate approaches to syntax analysis including probabilistic context-free grammars	3	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO-3:	Apply approaches to semantics and discourse analysis in NLP.	3	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO-4:	Develop models using transfer learning approaches.	3	-	-	3	3	-	-	-	-	-	-	-	2	-	-
CO-5:	Implement applications that use Natural Language Processing approaches.	-	-	2	3	3	-	-	-	-	-	-	-	-	-	-

Unit-1 : Overview and Word Level Analysis
Introduction to Natural Language Processing, Applications of NLP, Levels of NLP, Regular Expressions, Morphological Analysis, Tokenization, Stemming, Lemmatization, Feature extraction: Term Frequency (TF), Inverse Document Frequency (IDF), Modeling using TF-IDF, Parts of Speech Tagging, Named Entity Recognition, N-grams, Smoothing.

Unit-2 : Syntax Analysis
Context Free Grammars, Grammar Rules for English, Top-Down Parsing, Bottom-Up Parsing, Ambiguity, CKY Parsing, Dependency Parsing, Earley Parsing - Probabilistic Context-Free Grammars

Unit-3: Semantic and Discourse Analysis
Representing Meaning, Lexical Semantics, Word Senses, Relation between Senses, Word Sense Disambiguation, Word Embeddings, Word2Vec, CBOW, Skip-gram and GloVe, Discourse Segmentation, Text Coherence, Discourse Structure, Reference Resolution, Pronominal Anaphora Resolution, Coreference Resolution

Unit-4: Language Models
Recurrent Neural Networks (RNN), Long Short-Term Memory (LSTM), Attention mechanism, Transformer Based Models, Self-attention, multi-headed attention, BERT, RoBERTa, Fine Tuning for downstream tasks, Text classification and Text generation.

Unit-5: NLP Applications
Introduction to Chatbot Applications, Retrieval based- Conversation based, Information Extraction and its approaches, Information Retrieval, Semantic Search and Evaluation, Question Answering, Summarization, Extractive Vs Abstractive Summarization, Machine Translation.

Learning Resources

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2nd Edition, 2018.
2. C.Manning and H.Schutze, —Foundations of Statistical Natural Language Processing‖, MIT Press. Cambridge,MA:,1999
3. JamesAllen,Bejamin/cummings,—NaturalLanguageUnderstanding‖,2ndedition,1995
4. Rothman, Denis. Transformers for Natural Language Processing: Build innovative deep neural network architectures for NLP with Python, PyTorch, TensorFlow, BERT, RoBERTa, and more. Packt Publishing Ltd, 2021.
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 (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 – (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	25%	-	25%	-
Level 3	Apply	30%	-	30%	-	30%	-
Level 4	Analyze	30%	-	30%	-	30%	-
Level 5	Evaluate	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr. J.Balaji, Associate Manager,Allstate Solutions Pvt Ltd, jagank.balaji@gmail.com	Dr. Vani. V, Assistant Professor, National Institute of Technology Puducherry	1.Dr. R. Anita, SRMIST. 2.Dr.Subalalitha C.N , SRMIST 3. Ms.Viji D , SRMIST

Course Code	21CSE357T	Course Name	Distributed Computing	Course Category	E	Professional Elective	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computing Technologies	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Infer knowledge in distributed computing
CLR-2 :	Introduce about snapshot recording and graph algorithm
CLR-3 :	Demonstrate about various distributed mutual exclusion algorithms
CLR-4 :	Understanding about various Deadlock Detection
CLR-5 :	Outline the knowledge about Checkpointing and rollback recovery

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)												Program Specific outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2	PSO-3
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and society	Environment &	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning			
CO-1:	Use the appropriate concepts of Distributed computing for resource utilization	-	-	2	2	2	-	-	-	-	-	-	-	1	-	-
CO-2:	Formulate various Snapshot Recording and Graph Algorithms	-	-	2	2	2	-	-	-	-	-	-	-	2	-	-
CO-3:	Apply appropriate Distributed mutual exclusion algorithms	-	-	3	3	3	-	-	-	-	-	-	-	2	-	-
CO-4:	Design an deadlock system to implement various deadlock detection algorithms	-	-	3	3	3	-	-	-	-	-	-	-	2	-	-
CO-5:	Develop and implement various Checkpointing and rollback recovery	-	-	2	2	2	-	-	-	-	-	-	-	2	-	-

Unit-1 : Introduction to distributed computing

Primitives for distributed communication, Synchronous versus asynchronous executions, Design issues and challenges, A model of distributed executions, Global state of a distributed system, Cuts of a distributed computation, A framework for a system of logical clocks, Jard–Jourdan's adaptive technique, Physical clock synchronization: NTP, Classifications and basic concepts, Complexity measures and metrics

Unit-2 : Snapshot Recording and Graph Algorithms

Snapshot algorithms for FIFO channels, Variations of the Chandy–Lamport algorithm, Snapshot algorithms for non-FIFO channels Snapshots in a causal delivery system, Monitoring global state, Necessary and sufficient conditions for consistent global Snapshots, Finding consistent global snapshots in a distributed computation, Elementary graph algorithms. A spanning-tree-based termination detection algorithm

Unit-3: Distributed mutual exclusion algorithms

Lamport's algorithm, Ricart–Agrawala algorithm, Singhal's dynamic information-structure algorithm, Lodha and Kshemkalyani's fair mutual exclusion algorithm, Quorum-based mutual exclusion algorithms, Maekawa's algorithm, Agarwal–El Abbadi quorum-based algorithm, Token-based algorithms, Suzuki–Kasami's broadcast algorithm, Raymond's tree-based algorithm

Unit-4 : Deadlock Detection

Models of deadlocks, Knapp's classification of distributed deadlock detection Algorithms, Mitchell and Merritt's algorithm for the single-resource model, Chandy–Misra–Haas algorithm for the AND model, Chandy–Misra–Haas algorithm for the OR model, Kshemkalyani–Singhal algorithm for the P-out-of-Q model

Unit-5: Checkpointing and rollback recovery

Background and definitions, Issues in failure recovery, Checkpoint-based recovery, Log-based rollback recovery, Koo–Toueg coordinated checkpointing algorithm, Juang–Venkatesan algorithm for asynchronous checkpointing and recovery, Manivannan–Singhal quasi-synchronous checkpointing algorithm , Peterson–Kearns algorithm based on vector time, Helary–Mostefaoui–Netzer–Raynal communication-induced protocol.

Learning Resources	1.Distributed Computing: Principles, Algorithms, and Systems Paperback – 3 March 2011 by Ajay D. Kshemkalyani (Author), Mukesh Singhal (Author 2. Tanenbaum S.: Distributed Operating Systems, Pearson Education	3. Tanenbaum S. Maarten V.S.: Distributed Systems Principles and Paradigms, (Pearson Education) 4. George Coulouris, Jean Dollimore. Tim Kindberg: Distributed Systems concepts and design.

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 – (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr. T. Ruso. Senior Project Lead, HCL Technologies,Chennai	1. Dr.T.Sethukarasi, Professor and Head, Dept of CSE, RMK Engineering College	1. Dr.G.Padmapriya
	2.	2.

Course Code	21CSE358T	Course Name	Network Security and Cryptography	Course Category	E	Professional Elective	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computing Technologies	Data Book / Codes / Standards			

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understanding the basic concepts of security services and its mechanisms
CLR-2 :	Apply the different symmetric key cryptographic techniques
CLR-3 :	Analyze the various asymmetric key cryptographic techniques
CLR-4 :	Apply the message authentication and hash functions
CLR-5 :	Develop the security applications in networks

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)												Program Specific outcomes		
		1 Engineering Knowledge	2 Problem Analysis	3 Design/development of solutions	4 Conduct investigations of complex problems	5 Modern Tool Usage	6 The engineer and society	7 Environment & Sustainability	8 Ethics	9 Individual & Team Work	10 Communication	11 Project Mgt. & Finance	12 Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Acquire the knowledge of security services and techniques	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Analyze the symmetric key algorithms	2	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Apply the various asymmetric key algorithms	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Evaluate the various MAC and Hash functions	-	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Analyze the security applications	-	-	3	-	2	-	-	-	-	-	-	-	-	-	-

Unit-1 : Introduction to security concepts

The need for security- Security approaches- Principles of security- Types of Security attacks- Security services- Security Mechanisms- A model for Network Security- substitution techniques- transposition techniques- steganography.

Unit-2 : Symmetric Key Cryptography

Algebraic structures – Divisibility and division algorithm - Euclidean algorithm- Modular arithmetic-Prime numbers - Fermats and Eulers theorem - Congruence and matrices - Block Ciphers and operations - Simplified Data Encryption Standard - Data Encryption Standard - Advanced Encryption Standard

Unit-3: Asymmetric Key Cryptography

Groups, Rings, Fields- Finite fields - Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange- Elliptic Curve Cryptography-

Unit-4 : Message Authentication Algorithms and Hash Functions

Message Authentication, Secure Hash Algorithm (SHA-3)- Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme- Kerberos, X.509 Authentication Service, Public – Key Infrastructure.

Unit-5: Security in networks

Web security considerations-Secure Socket Layer and Transport Layer Security-Secure electronic transaction- Email security - PGP, S/MIME-Intruders-Intrusion detection- password management -virus and related threats- Countermeasures- Firewall design principles- types of firewalls, Case Studies on Cryptography and security: Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability, Virtual Elections

Learning Resources	1. Cryptography and Network Security Principles and Practice Seventh Edition, William Stallings, Pearson 2017. 2. [BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2010.	3. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition,2013.

Learning Assessment								
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 – (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice

Level 1	Remember	15%	-	25%	-	15%	-
Level 2	Understand	25%	-	25%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
	2.	2. Dr.G.K.Sandhia
	3.	3.

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Course Code	21CSE359T	Course Name	Information Storage Management	Course Category	E	Professional Elective	L	T	P	C
							2	1	0	3

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

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1	:Acquire the knowledge on the components of storage infrastructure
CLR-2 :	Learn the various types of Storage evolution architecture
CLR-3 :	Understand the business continuity, backup and recovery methods.
CLR-4 :	Introduce the working principle of storage infrastructure with monitoring principles
CLR-5 :	Understand the structure of cloud computing and its techniques

Course Learning Outcomes (CO):	At the end of this course, learners will be able to:
CO-1 :	Understand the ledge on the components of storage infrastructure
CO-2 :	Gain knowledge to evaluate storage architectures including storage subsystems
CO-3 :	Understand the business continuity, backup and recovery methods.
CO-4 :	Appreciate the concepts of storage security and information security applied to virtual machine
CO-5 :	Acquire the knowledge on structure of cloud computing and its techniques

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

Unit-1: INTRODUCTION TO INFORMATION STORAGE AND MANAGEMENT 9 hours

Introduction to Information Storage Management- Evolution of Storage Architecture- Data Centre Infrastructure- Evaluate storage architectures and key data center elements in classic, virtualized and cloud environments- physical and logical components of a storage infrastructure including storage subsystems, RAID and intelligent storage systems- Intelligent Storage Array

T1: A hospital application stores the Patient records with core elements of the data center. Discussion of typical challenges the storage management team may face in meeting the service-level demands of the hospital staff

T2: Design RAID- Real Life Scenario Business Application for Acme Telecom

Unit-2: INTRODUCTION TO SAN, IPSAN and CAS 9 hours

storage networking technologies -SAN- FCSAN- IP-SAN, *IPSAN-iSCSI components* FCoE- NAS and object-based, and unified storage (CAS) – NAS I/O Operations- NAS Implementations

T5: USRobotics Mini NAS provides easy backup and remote access for college office setting

T6: SAN Infrastructure implementation at Heterogeneous environment

T7: Configuration and Tracing of FC scan and iSCSI scan

Unit-3: INTRODUCTION TO ELECTRONIC STORAGE INFORMATION 9 hours

Electronically Stored Information and the Federal Rules of Civil Procedure- Changes to the Federal Rules of Civil Procedure-Federal Rules of Evidence-The (Long) List of Stakeholders-Ownership of Data-Data Control Considerations-*Business Continuity (BC) Terminology, BC Planning life cycle- Failure Analysis, Business Impact Analysis-Automatic Path fail over-Backup granularities*

T7: Discussion of Social Media Cases and Spoliation Cases

T8: Use Backup techniques for archived data

T9: Implement appropriate backup and restore model in virtual environments for sensitive information

Unit-4: INTRODUCTION TO STORAGE SECURITY, RECOVERY AND AQUISION 9 hours Applications as a Vital User Interface-Hidden or Restricted Access Data -Privileged, Sensitive, and Inaccessible Data Management-Proving Ownership and Integrity-Legal and Forensically Sound Acquisition -Securing the Data-Access Control and Management-Organization and File Management Techniques-Safe Storage Issues and Considerations *Information Security Framework-Risk Triad-Storage Security Domains.* T10: Analyze various monitoring parameters in secured storage environment T11: Creation of Linux Instance in Public Cloud Generate a private key, Access using SSH client T12: Usage of *RSA and VMware Security Products*
Unit-5: CLOUD STORAGE 9 hours key characteristics, services, deployment models, and infrastructure components for a cloud computing-Cloud Infrastructure Mechanism-Cloud Infrastructure Mechanism: Cloud Infrastructure Mechanism-Logical Network Perimeter-Cloud Usage Monitor-Cloud Adoption Considerations-Cloud Storage Gateways T13: Building programs to deploy cloud applications T14: Usage of Cloud services with open-source cloud tools (like Eucalyptus, Openstack, Open Nebula and others)

Learning Resources	1.David R Matthews, Electronically Stored Information The Complete Guide to Management, Understanding, Acquisition, Storage, Search, and Retrieval, Second Edition 2.EMC Corporation, ―Information Storage and Managementǁ,2nd edition Wiley India, ISBN13: 978-1118094839 3. Thomas Erl, ―Cloud Computing: Concepts, Technology & Architectureǁ, Prentice Hall , 2013,ISBN: 9780133387568	4. UifTroppen Rainer Wolfgang Muller,ǁStorage Networks Explainedǁ, India, Wiley, 2010, ISBN13: 978- 0470741436

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA) - By the Course Faculty		By The CoE
		Formative CLA-I Average of unit test (50%)	Life Long* Learning CLA-II- Practice (10%)	Summative Final Examination (40% weightage)
		Theory	Theory	Theory
Level 1	Remember	40%	20%	40%
Level 2	Understand	40%	20%	40%
Level 3	Apply	10%	20%	10%
Level 4	Analyze	10%	20%	10%
Level 5	Evaluate	-	10%	-
Level 6	Create	-	10%	-
	Total	100 %	100 %	100 %

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
	1. Dr.V.Masillamani	1. Dr.D.Hemavathi, DSBS

Course Code	21CSE360T	Course Name	High Performance Computing	Course Category	E	Professional Elective	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	
Course Offering Department	Computing Technologies	Data Book / Codes / Standards			

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understand the concepts of advanced processors
CLR-2 :	Learn the core of high end computers, components and their capacities
CLR-3 :	Understand the need for parallel algorithms
CLR-4 :	Build applications using parallel programming paradigm
CLR-5 :	Build solutions using programming model

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)												Program Specific outcomes		
		1 Engineering Knowledge	2 Problem Analysis	3 Design/development of solutions	4 Conduct investigations of complex problems	5 Modern Tool Usage	6 The engineer and society	7 Environment &	8 Ethics	9 Individual & Team Work	10 Communication	11 Project Mgt. & Finance	12 Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Elucidate on advanced processors	-1	-1	-	-	-1	-	-	-	-	-	-	-	-	-	-
CO-2:	Analyze the working of cluster and sky computing	1-	-	1-	1-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Apply Parallel Algorithmic concepts to solve problems	-	-3	-3	-1	-	-	-	-	-	-	-	-	-	3	-
CO-4:	Develop applications using OpenMP and MPI	-	1-	-1	-1	-	-	-	-	-	-	-	-	-	3	-
CO-5:	Describe GPU architecture and write programs using CUDA	-	-	-1	-1	2-	-	-	-	-	-	-	-	-	3	-

Unit-1 : Fundamentals of parallel processors

Stored Program Computer Architecture- General purpose cache- based microprocessor-Performance based metrics and benchmarks- Moore's Law- Pipelining- Superscalarity- SIMD- Memory Hierarchies Cache- mapping- prefetch- Multicore processors- Mutithreaded processors- Vector Processors- Design Principles- Maximum performance estimates- Programming for vector architecture – Data flow computers and VLSI Computations – Need for Migrating to Nanoscale Processors – Design of Quantum Processors and Quantum Logic gates with Qubits Processing

Unit-2 : - Performance Enhancement Computing Cluster Computing and Sky Computing

Introduction to Cluster Computing- Scalable Parallel Computer Architectures- Cluster Computer and its Architecture- Classifications, Components for Clusters- Cluster Middleware and Single System Image- Resource Management and Scheduling, Programming Environments and Tools, Applications, Representative Cluster Systems, Heterogeneous Clusters, Security, Resource Sharing, Locality, Dependability, Cluster Architectures, Detecting and Masking Faults, Recovering from Faults, Condor, Evolution of Metacomputing. Virtualised Architecture for Cloud Computing Storage, Hypervisor usage and Integration of Cloud Computing for Sky Computing Model

Unit-3: Perspective of Parallel Algorithms

Principles of parallel algorithm design - Data Parllel, Task graph, Work pool, master- slave, pipeline, Hybrid – Non – numerical algorithms, sorting, graph algorithms, search algorithms for discrete optimization problems,Dynamic programming – Numerical algorithms, Dense matrix algorithms, fast Fourier transforms

Unit-4 : Constructs of Parallel Programming Introduction to parallel computing – parallel programming platforms – Basic communication operations –Programming using message passing paradigm , MPI– Programming shared address space platforms, POSIX threads , open MP
Unit-5: GPU ARCHITECTURE AND PROGRAMMING Hardware Architecture – Integrated GPUs –Multi GPUs – GPU Architecture - Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory and Texture Memory. Introduction to CUDA C , parallel programming in CUDA C , Thread cooperation- Shared Memory and Synchronization

Learning Resources	1.Georg Hager, Gerhard Wellein, Introduction to High Performance Computing for Scientists and Engineers, Chapman & Hall / CRC Computational Science series, 2011. 2. Parag K. Lala "Quantum Computing: A Beginners Introduction", Mc Graw Hill, 2020. 3. R. Buyya, High Performance Cluster Computing: Architectures and Systems, Volume 1, Pearson Education, 2008. 4. Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Welsey, 2003.	5. Nicholas Wilt, ―CUDA Handbook: A Comprehensive Guide to GPU Programmingǁ, Addison - Wesley, 2013. 6. Jason Sanders, Edward Kandrot, ―CUDA by Example: An Introduction to General Purpose GPU Programmingǁ, Addison - Wesley, 2010. https://link.springer.com/article/10.1007/s10586-017-0727-5 http://www.nvidia.com/object/cuda_home_new.html

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 – (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	25%	-	15%	-
Level 2	Understand	25%	-	25%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-		-	-	-
Level 6	Create	-	-		-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.Hemant Giri , NIVIDIA	1. Dr.R.S.Singh, IIT, BHU, Varanasi	1. Dr.R.S.Ponmagal
2.AmarendraMohanty, AdvantagePro	2. Dr.Pradheepkumar, BITS, PILANI	2. Dr.Sathyapriya

Course Code	21CSE361T	Course Name	Database Security and Privacy	Course Category	E	Professional Elective	L	T	P	C
							3			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 :	Realize the fundamentals of security relates to information
CLR-2 :	Gain knowledge of how security is maintained in information systems
CLR-3 :	Comprehend the concept of security models in database
CLR-4 :	Study about the practices of database auditing
CLR-5 :	Implementation of data mining algorithms for PPDM

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)												Program Specific outcomes		
		1 Engineering Knowledge	2 Problem Analysis	3 Design/development of solutions	4 Conduct investigations of complex problems	5 Modern Tool Usage	6 The engineer and society	7 Environment & Sustainability	8 Ethics	9 Individual & Team Work	10 Communication	11 Project Mgt. & Finance	12 Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Acquire the knowledge of information system and information security	3	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Manage the security of information system as well as database	3	3	-	-	1	-	-	-	-	-	-		-	-	-
CO-3:	Design and develop the security model in database	3	-	3	-	-	-	-	-	-	-	-	2	-	-	-
CO-4:	Mange the audit database activities, users, security	3	-	-	2		-	-	-	-	-	-	-	-	-	-
CO-5:	Apply the security mechanism in PPDM using various algorithms	3	2	2	-		-	-	-	-	-	-	-	-	-	-

Unit-1 :	Security Architecture: Introduction, Information Systems, Database Management Systems, Information Security Architecture, Database Security, Asset Types and Their value, Security Methods. Operating System Security Fundamentals: Introduction, Operating System Overview, The Components of an Operating System Security Environment, Authentication Methods, User Administration, Password Policies ,Vulnerabilities of Operating Systems , Email Security, Internet security	9
Unit-2 :	Administration of Users: Introduction, Documentation of User Administration, Operating System Authentication, Creating Users, Creating a SQL Server user, Removing users, Modifying users, Default users, Remote users, Database Links ,Linked Servers, Remote Servers Practices for Administrators and Managers, Profiles, Password Policies. Privileges and Roles: Introduction, Defining and Using Profiles, Designing and Implementing Password Policies, Granting and Revoking User Privileges, Creating, Assigning and Revoking User Roles ,Best practices	9
Unit-3:	Database Application Security Models: Types of Users, Security Models, Application Types, Application Security Models, Transparent Data Encryption, Column Encryption Full Database Encryption, Column level Security with SQL Server. Virtual Private Databases: Implementation of VPD using Views, Application Context in Oracle, Implementing Oracle VPD, Viewing VPD Policies, VPD using views, Application contexts using Data Dictionary, Policy Manager Implementing Row and Column level Security with SQL Server	9
Unit-4 :	Audits: Ways to Audit a Database, Application API Code, Auditing with Trigger Code ,Normal Audit, Unified Audit ,Fine Grained Auditing, Comparing Methods Auditing Database Activities: Oracle Database Activities, Creating DLL Triggers with Oracle, Auditing Database Activities with Oracle, Auditing Server Activity with SQL Server 2022, Auditing Server Activity with Oracle21c, Case study: project security and auditing	9

Unit-5: Privacy Preserving Data Mining Techniques ,Privacy Preserving Data Mining Models and Algorithms-The Randomization Method, Group Based Anonymization, Distributed Privacy-Preserving Data Mining, Privacy-Preservation of Application Results, Applications of Privacy-Preserving Data Mining. Case study: Joseph Domingo-Ferrer, Nine Measures of Anonymity, k-Anonymous Data Mining	9	

Learning Resources	7. HassanA.Afyouni, "Database Security and Auditing Protecting Data Integrity and Accessibility", Third Edition, Cengage Learning, 2013. 8. RonBenNatan," Implementing Database Security and Auditing", Elsevier Digital Press,2005	9. 3.Osama Mustafa and Robert P. Lockard," Oracle Database Application Security With Oracle Internet Directory, Oracle Access Manager, and Oracle Identity Manager", First Edition Apress Publishers, 2019 10. 4.Charu C. Aggarwal and Philip S Yu," Privacy Preserving Data Mining Models and Algorithms", Kluwer Academic Publishers, 2008

Learning Assessment								
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 – (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	25%	-	25%	-
Level 3	Apply	30%	-	30%	-	30%	-
Level 4	Analyze	30%	-	30%	-	30%	-
Level 5	Evaluate	-	-		-	-	-
Level 6	Create	-	-		-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr.S.Kumarasamy, Assistant Manager - MSSQL ,Sify Technologies Limited,Chennai-600113	3. Dr.L.Jayakumar, Assistant professor, Department of computer science and engineering, National institute of technology, Agartala, Tripura.	3. Dr.S.Gnanavel
	2. Dr.K.Jayashree, Professor, Panimalar engineering college, Chennai	4. Dr.C.Pretty Diana Cyril

Course Code	21CSE362T	Course Name	CLOUD COMPUTING	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computing Technologies	Data Book / Codes / Standards			

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understand the cloud concepts with its features
CLR-2 :	Learn the cloud architecture and services
CLR-3 :	Comprehend Security aspects for Cloud platforms
CLR-4 :	Study the basic concepts of Virtualization and capacity planning
CLR-5 :	Gain knowledge on Cloud Applications of different service providers

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)												Program Specific outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and society	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Exhibit knowledge on basics of Cloud Computing	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Identify then type of services for various applications	1	3	1	-		-	-	-	-	-	-	-	-	-	-
CO-3:	Predict the type of security to be applied for various cloud services	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Examine the concept of virtualization and capacity planning	2	1		-	2	-	-	-	-	-	-	-	-	-	-
CO-5:	Recommend the service provider for specific requirement	2	-		1	2	-	-	-	-	-	-	-	-	-	-

Unit-1 : Fundamentals of Cloud Computing: Define Cloud Computing
Cloud Types
Characteristics of Cloud Computing
Benefits and disadvantages of cloud systems
Assessing the Value Proposition
Measuring the Cloud's Value
Capital Expenditures
Total Cost of Ownership
Service Level Agreements
Licensing Models

Unit-2 : Cloud Architecture and Services:
Cloud Computing Stack
Composability, Infrastructure, Platforms and Virtual Appliances
Communication Protocols and Applications
Connecting to the Cloud
Infrastructure as a Service (IaaS)
Platform as a Service (PaaS), Software as a Service (SaaS)

Unit-3: Cloud Security :
Cloud Security Challenges
Software-as-a-Service Security
End-User Access to Cloud Computing Overview
Identity Protocol Standards
Windows Azure Identity Standards

Unit-4 :Virtualization and Capacity Planning: Virtualization Technologies Abstraction versus Virtualization Load Balancing and Virtualization The Google Cloud Hypervisors Virtual Machine Imaging Porting Applications Capacity Planning
Unit-5: Cloud Computing Applications
Web Services: Amazon, Microsoft, Google Case Studies: Cloud as Infrastructure for an Internet Data Center (IDC) Cloud Computing for Software Parks Enterprise with Multiple Data Centers

Learning Resources	1.Barrie Sosinsky (2011), "Cloud Computing Bible" Wiley Publishing Inc. 2. John W. Rittinghouse and James F. Ransome (2010), "Cloud Computing, Implementation, Management, and Security", CRC Press. 3. Borko Furht, Armando Escalante (2010), "Handbook of Cloud Computing", Springer.	4. Michael Kavis, (2014) "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, AND IaaS)", John Wiley & Sons. 5. Sunil kumar Manvi, Gopal K. Shyam (2021) "Cloud Computing: Concepts and Technologies", CRC Press, 1st edition.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 – (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	20%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	30%	-	30%	-
Level 4	Analyze	30%	-	30%	-	30%	-
Level 5	Evaluate	-	-		-	-	-
Level 6	Create	-	-		-	-	-
	Total	100 %		100 %		100 %	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. T. Ruso, Senior Project Lead, HCL Technologies, Chennai	4. Dr. P. Varalakshmi, Professor, MIT, AnnaUniversity, Chennai	4. Dr. D. Malathi, Professor, CTECH, SRM IST
2. Mr. Saju G Nair, Senior Development Manager Kyndryl India Pvt Ltd.	4. Dr. S. Gopika, Kristu Jayanti College, Bangalore.	5. Dr. J. D. DorathiJayaseeli, Assistant Professor, CTECH, SRM IST

Course Code	21CSE451T	Course Name	PATTERN RECOGNITION TECHNIQUES	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nill	Co- requisite Courses	Nill	Progressive Courses	Nill
Course Offering Department	COMPUTING TECHNOLOGIES	*Data Book / Codes / Standards*			

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	Know about various techniques in pattern recognition
CLR-2 :	Develop good knowledge of Bayesian Theory
CLR-3 :	Explore the various Non-Parametric techniques
CLR-4 :	Understand the Linear Discriminant functions
CLR-5 :	Utilize Artificial Neural networks for classification problems

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific outcomes		
		1 Engineering	2 Problem Analysis	3 Design/development of solutions	4 Conduct investigations of complex problems	5 Modern Tool Usage	6 The engineer and	7 Environment &	8 Ethics	9 Individual & Team	10 Communication	11 Project Mgt. & Finance	12 Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Identify the various techniques involved in pattern recognition	3	-	-	-	-	-	-	-	-	-	-	-	1 -	-	-
CO-2:	Summarize Bayesian decision theory and Bayesian learning	3	2	-		-	-	-	-	-	-	-	-	-	2	-
CO-3:	Categorize the various Non-Parametric techniques	2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO-4:	Formulate appropriate Linear Discriminant Function, Nearest neighbor rule, Neural Network and SVM for the problem statement	3	-2	-		-	-	-	-	-	-	-	-	-	2	-
CO-5:	Demonstrate the Artificial Neural Network based Pattern recognition	3	-	2	-	2	-	-	-	-	-	-	-	-	-	2

Unit-1 : Introduction to Pattern recognition Systems

Basics of Probability, Independence of events, Conditional and Joint probability, Machine perception, Pattern Recognition Systems, The Design cycle, Learning and Adaptation, Minimum-error-rate classification, Classifiers, Discriminant functions, Decision surfaces, Normal density and discriminant functions

Unit-2 : Parameter Estimation Methods

Maximum Likelihood Estimation, Bayesian Estimation, Bayesian Parameter Estimation: Gaussian case, Bayesian Parameter Estimation: General Theory, Problems of Dimensionality, Component Analysis and Discriminants, Expectation-Maximization, Hidden Markov Model

Unit-3: Non-Parametric Techniques

Density Estimation, Parzen Windows, K- Nearest Neighbor Estimation, The Nearest Neighbor Rule, Metrics and Nearest Neighbor classification, Fuzzy classification, reduced coulomb energy networks, Approximations by series expansions

Unit-4 : Linear Discriminant Functions

Linear Discriminant Functions and Decision Surfaces, Generalized Linear Discriminant Functions, Two-category linearly separable case, Perceptron criterion functions, Relaxation procedures, Nonseparable Behavior, Minimum Squared Error procedures, Linear Programming Algorithms, Support Vector Machines

Unit-5: Multilayer Neural Networks and Nonmetric Methods

Introduction to Neural Networks. Multilayer Neural Networks: Feedforward operations and classification, Backpropagation algorithms, Nonmetric methods: Decision Trees, CART, Applications: Face recognition System

Learning Resources

1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley 2001
2. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009
3. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006
4. P.A Devijver and J. Kittler, Pattern Recognition: A Statistical Approach, Prentice-Hall, International, Englewood Cliffs, NJ, 1980.
5. K. Fukunaga, Introduction to Statistical Pattern Recognition, 2nd Ed. Academic Press, New York, 1990.
6 Wu, Jianxin. Essentials of Pattern Recognition: An Accessible Approach. United Kingdom, Cambridge University Press, 2020.
7.Bengio, Y., Goodfellow, I., Courville, A. (2016). Deep Learning. United Kingdom: MIT Press.

Learning Assessment							
	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*15%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*25%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	*30%*	-	*30%*	-
Level 4	*Analyze*	*30%*	-	*30%*	-	*30%*	-
Level 5	*Evaluate*	-	-		-	-	-
Level 6	*Create*	-	-		-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr.Peter PethuruRaj, Jio Cloud, Bengaluru 2.Mr. Srivathsa Pasumarthi, Senior Research Scientist Subtle Medical, Menlo Park,California, USA	1. Dr.S.Chithra, Associate Professor, SSN College of Engineering, Chennai	1. Dr.B.Baranidharan, Associate Professor, Dept of C.Tech, SRMIST

Course Code	21CSE452T	Course Name	Semantic Web	Course Category	E	Professional Elective	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	*Computing Technologies*	*Data Book / Codes / Standards*			

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1:	*Understand the basic concepts of semantic web*
CLR-2:	*Analyze the Ontology terminologies*
CLR-3:	*Investigate the concepts of semantic web services*
CLR-4:	*Construct and map Ontologies*
CLR-5:	*Apply semantic web knowledge using XML*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific outcomes		
		1 Engineering Knowledge	2 Problem Analysis	3 Design/development of	4 Conduct investigations of complex problems	5 Modern Tool Usage	6 The engineer and society	7 Environment & Sustainability	8 Ethics	9 Individual & Team Work	10 Communication	11 Project Mgt. & Finance	12 Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	*Acquire knowledge about Semantic Web*	*3*	*2*	-	-	*3*		-	-	-	-	-	-	-	*3*	-
CO-2:	*Recognize Ontology Terminologies*	-	-	*2*	-	*2*	-	-	-	-	-	-	-	-	*3*	-
CO-3:	*Analyze the XML web services*	-	*3*	-	*2*	-	-	-	-	-	-	-	-	-	*3*	-
CO-4:	*Apply Ontology concepts*	-	-	*3*	-	*2*	-	-	-	-	-	-	-	-	*3*	-
CO-5:	*Design XML documents*	2	-	*3*	*3*	-	-	-	-	-	-	-	-	-	*3*	-

Unit-1: The Semantic Web
The Semantic Web: Introduction - Scenario - Layer Cake. Describing Data with RDF- properties - visualization, RDF Applications. Topic Maps - Introduction - Examples- Comparison with Web and RDF. Annotations - Searching - Strategies. Logic - order - pitfalls

Unit-2: Understanding Ontologies
Graphical ontology example: Human resources., Definitions-Syntax, Structure, Semantics, and Pragmatics- Ontology and Semantic Mapping Problem-Knowledge Representation: Languages, Formalisms, Logics- Levels of Ontologies- OWL-Ontologies Today

Unit-3: Semantic Web Services
Web Services-Invoking-Describing-finding services. Intelligent agents-Types-Interactions-Frameworks-Standards. Distributed trust and belief-tools of trust-

Unit-4: Ontology Engineering
Constructing Ontologies Manually-Reusing Existing Ontologies-Semiautomatic Ontology Acquisition-Ontology Mapping-Exposing Relational Databases-Semantic Web Application Architecture

Unit-5: Case Studies with XML
The XML Language-Structuring-Namespaces-Addressing and Querying XML Documents-Processing-Case Studies: Friend of a Friend-Browser Bookmarks-Crafting Your Company's Roadmap to the Semantic Web

Learning Resources	Thomas.B.Passin: Explorer's guide to the semantic web. Manning Publications Company 2004, ISBN 978-1-932394-20-7, pp. I-XXII, 1-281 Michael C, Daconta, Leo J. Obrst and Kevin T. Smith, "The semantic Web: A guide to the future of XML, web services, and knowledge management", John wiley & sons, 2003.	Grigoris Antoniou and Frank Van Harmelen, "A Semantic Web Primer", The MIT Press, Cambridge, Massachusetts London, England, 2004. www.semanticweb.org

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*25%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*25%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	*25%*	-	*30%*	-
Level 4	*Analyze*	*30%*	-	*25%*	-	*30%*	-
Level 5	*Evaluate*	-	-	-	-	-	-
Level 6	*Create*	-	-	-	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. R Velmurugan Manager, Cognizant	*1.Prof. Dr. J. I. Sheeba, Department of CSE, Puducherry Technological University, Pondicherry, India*	*1. Dr. Sindhu C, Computing Technologies*
2.	*2. Prof. Dr. K. Prasanth, Dept of IT, KSRCT, Tiruchengode, India*	*2. Mrs. R. Lavanya, Computing Technologies*

Course Code	21CSE453T	Course Name	Speech Recognition	Course Category	E	Professional Elective	L	T	P	C
							2	1	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 basics of Acoustics and Phonetics
CLR-2 :	Illustrate the concepts of Chatbots and Dialogue systems
CLR-3 :	Demonstrate the feature extraction process of speech recognition task
CLR-4 :	Apply the deep learning architecture for speech recognition task
CLR-5 :	Analyzing and applying the transfer learning models for machine translation task

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and society	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Familiarize the concepts of acoustics and phonetics	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-
CO-2:	Understand the applications of speech recognition	1	2	-	-	-	-	-	-	-	-	-	-	-	3	-
CO-3:	Identify the feature extraction process involved in speech recognition	3	-	3	2	-	-	-	-	-	-	-	-	-	3	-
CO-4:	Design and Develop the deep learning architecture	3	2	2	-	-	-	-	-	-	-	-	-	-	3	-
CO-5:	Understand the recent technologies in machine translation process	2	-	2	-	-	-	-	-	-	-	-	-	-	3	-

Unit-1 : **Introduction to Acoustic Phonetics**
Speech Sounds and Phonetic Transcription, Articulatory phonetics, Prosody, Acoustic Phonetics and Signals, Phonetic Resources

Unit-2 : **Chatbots & Dialogue Systems**
Properties of Human Conversation, Chatbots, GUS: Simple Frame-based Dialogue Systems, The Dialogue-State Architecture, Evaluating Dialogue Systems, Dialogue System Design

Unit-3: Automatic Speech Recognition and Text-to-Speech
The Automatic Speech Recognition Task, Feature Extraction for ASR: Log Mel Spectrum, Speech Recognition Architecture, CTC, ASR Evaluation: Word Error Rate, TTS

Unit-4: **Deep Learning Architectures for Sequence Processing**
Language Models Revisited, Recurrent Neural Networks, RNNs as Language Models, RNNs for other NLP tasks, Stacked and Bidirectional RNN architectures, The LSTM, Self-Attention Networks: Transformers, Transformers as Language Models, Contextual Generation and Summarization

Unit-5: **Machine Translation and Encoder-Decoder Models**
Language Divergences and Typology, The Encoder-Decoder Model, Encoder-Decoder with RNNs, Attention, Beam Search, Encoder-Decoder with Transformers, Some practical details on building MT systems, MT Evaluation

Learning Resources

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2nd Edition, 2018.
2. L. Rabiner and B. H. Juang, Fundamentals of Speech Recognition, Prentice Hall, 1993
3. Wang, Y., Skerry-Ryan, R.J., Stanton, D., Wu, Y., Weiss, R.J., Jaitly, N., Yang, Z., Xiao, Y., Chen, Z., Bengio,
4. Ren, Y., Ruan, Y., Tan, X., Qin, T., Zhao, S., Zhao, Z., and Liu, T. Y. Fastspeech: Fast, robust and controllable text to speech. Advances in Neural Information Processing Systems 32. 2019.
5. Sutskever, Ilya, Oriol Vinyals, and Quoc V. Le. Sequence to sequence learning with neural networks arXiv 2014

	S. and Le, Q., Tacotron: Towards end-to-end speech synthesis. arXiv. 2017.	6. The Illustrated Transformer – Jay Alammar – Visualizing machine learning one concept at a time

Learning Assessment							
	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*15%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*20%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	*25%*	-	*30%*	-
Level 4	*Analyze*	*30%*	-	*25%*	-	*30%*	-
Level 5	*Evaluate*	-	-	*10%*	-	-	-
Level 6	*Create*	-	-	*5%*	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr. J.Balaji, Associate Manager,Allstate Solutions Pvt Ltd, jagank.balaji@gmail.com	1. *Dr Gautam Srivatsava, Brandon University, Cananda*	1. *Dr. R. Srinivasan, Assistant Professor, SRMIST,KTR.*
	2. *Mr Tamilanaban, IBM Software Labs, Bangalore*	2. *Dr.Subalalitha C.N, Associate professor, SRMIST, KTR.*

Course Code	21CSE454T	Course Name	Computer Vision	Course Category	E	Professional Elective	L	T	P	C
							2	1	0	3

Pre-requisite Courses	NIL	Co- requisite Courses	NIL	Progressive Courses	Nil
Course Offering Department	Computing Technologies	*Data Book / Codes / Standards*	Nil		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	Introduce students the foundations of Image Processing Techniques.
CLR-2 :	Understand the shape and region analysis.
CLR-3 :	Understand the HOUGH TRANSFORM and its applications to detect lines, circles, ellipses.
CLR-4 :	Understand the Three-dimensional image analysis techniques and Motion Analysis.
CLR-5 :	Study some applications of computer vision algorithms.

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific outcomes		
		1 Engineering	2 Problem Analysis	3 Design/development of solutions	4 Conduct investigations of complex problems	5 Modern Tool Usage	6 The engineer and	7 Environment &	8 Ethics	9 Individual & Team	10 Communication	11 Project Mgt. & Finance	12 Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Perform basic Point detection and Morphology.	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Perform shape analysis, implement boundary tracking techniques and a apply chain codes and other region descriptors	2	2	1	-	-	-	-	-	-	-	-	-	3	-	-
CO-3:	Apply Hough Transform for line, circle, and ellipse detections.	3	2	1	-	1	-	-	-	-	-	-	-	3	-	-
CO-4:	Apply 3D vision techniques. Implement motion related techniques.	2	-	-	-	-	-	-	-	-	-	-	-	3	-	2
CO-5:	Develop applications using computer vision techniques.	2	-	1	1	1	-	-	-	-	-	-	-	3	-	2

Unit-1 : IMAGE PROCESSING FOUNDATIONS

Image processing techniques - classical filtering operations - thresholding techniques - edge detection techniques - corner and interest point detection - mathematical morphology - texture.

Unit-2 : SHAPES AND REGIONS

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moment.

Unit-3: HOUGH TRANSFORM

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem –ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.

Unit-4 : VISION AND MOTION

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion.

Unit-5: APPLICATIONS

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.

Learning Resources	1. Computer Vision: Algorithms and Applications, Richard Szeliski, Springer-Verlag London Limited 2011 2. E. R. Davies, —Computer & Machine VisionII, Fourth Edition, Academic Press, 2012 3. D. L. Baggio et al., —Mastering OpenCV with Practical Computer Vision ProjectsII, Packt Publishing, 2012 4. Computer Vision: A Modern Approach, Forsyth, J. Ponce, Pearson Education, 2003.	5. Jan Erik Solem, —Programming Computer Vision with Python: Tools and algorithms for analyzing imagesII, O'Reilly Media, 2012. 6. Mark Nixon and Alberto S. Aquado, —Feature Extraction & Image Processing for Computer VisionII, Third Edition, Academic Press, 2012.] 7. Davies, E. R. (2017). Computer Vision: Principles, Algorithms, Applications, Learning. Netherlands: Elsevier Science. 8. Bhuyan, M. K. (2019). Computer Vision and Image Processing: Fundamentals and Applications. United States: CRC Press.

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	20%	-	*15%*	-
Level 2	*Understand*	*25%*	-	25%	-	*25%*	-
Level 3	*Apply*	*30%*	-	30%	-	*30%*	-
Level 4	*Analyze*	*30%*	-	*25%*	-	*30%*	-
Level 5	*Evaluate*	-	-	-	-	-	-
Level 6	*Create*	-	-	-	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. BharathKumar, Senior Software Developer, MalwareBytes, Estonia, bsadanandam@malwarebytes.com	Dr. K.Vivekanandan , Ph.D., Professor in Computer Science and Engineering , Pondicherry Engineering College, Puducherry-605014, k.vivekanandan@pec.edu	Dr M Suchithra, Associate Professor, Dept. of Computing Technologies.

Course Code	21CSE455T	Course Name	Social Network Analysis	Course Category	E	Professional Elective	L	T	P	C
							2	1	0	3

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

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	Familiarize the Concept of semantic web and the introduction to social network analysis
CLR-2 :	Get familiar with the modeling and aggregating of data from social networks.
CLR-3 :	Explore the method of extracting and mining data from social network communities
CLR-4 :	Understanding and predicting human behavior for social communities
CLR-5 :	Acquire the ability to implement social networks and visualize its applications

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2	PSO-3
		Engineering	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and	Environment &	Ethics	Individual & Team	Communication	Project Mgt. & Finance	Life Long Learning			
CO-1:	understand the concepts of semantic web and introduction of social network analysis	2	-	2	-3	-	-	-	-	-	-	-	-	-	2	2
CO-2:	Understand and design the roles of ontology in the semantic web	2		-2	-3	-	-	-	-	-	-	-	-	-	2	2
CO-3:	learn about the social network communities		3	2-	-	-3	-	-	-	-	-	-	-	-	2	2
CO-4:	understand and predict the human behavior for social communities	2		-3	-	-3	-	-	-	-	-	-	-	-	2	2
CO-5:	Design and implement the social network representations and visualize its applications	2	-	-3	-	2-	-	-	-	-	-	-	-	-	2	2

Unit-1 : Introduction
Introduction to Semantic web: Limitations of current web, Development of Semantic web, Emergence of the Social Web, Social Network analysis, Components, Development of Social Network Analysis, Key concepts and measures in network analysis, electronic sources for network analysis, Examples, Web-based networks, Examples with diagrams, Applications of Social Network Analysis, Examples

Unit-2 : Ontology and their role in the Semantic Web
Roles of Ontology, Ontology-based knowledge Representation, Explanation of Diagram, Ontology languages for the Semantic Web, Resource Description Framework, Web Ontology Language, Examples, Modeling and aggregating social network data, State-of-the-art in network data Representation, Aggregating, Advanced representations, Examples for Representations

Unit-3: Extraction and Mining communities in web social networks
Extracting evolution of Web Community from a Series of Web Archive, Definition of Community, Examples for Community, Detecting communities in social Networks, Examples for Detection of Communities, Algorithms, Tools for detecting communities social network infrastructures and communities, Examples for various tools

Unit-4 : Predicting Human behavior and Privacy issues
User data management, Inference and Distribution, Enabling new human experiences, Reality mining, Context, Privacy in online social networks, Trust model example, Trust network analysis, Trust transitivity Analysis

Unit-5: Visualization and Applications
Graph theory, Centrality, Clustering, Node, Edge diagrams, Matrix representation, Visualizing social networks with matrix based representation , Matrix, Node , Link diagrams, Hybrid representations, Applications: Cover networks, Community welfare, Collaboration networks, Co-Citation networks

Learning Resources	1.Peter Mika, "Social Networks and the Semantic Web", First Edition, Springer 2007. 2. Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010. 3. Guandong Xu,Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", First Edition Springer, 2011.	4. Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008. 5. Ian McCulloh, Helen Armstrong and Anthony Johnson, "Social Network Analysis with Applications", Wiley Publications, 2013. 6. Borgatti, S. P., Everett, M. G., & Johnson, J. C., "Analyzing social networks", SAGE Publications Ltd; 1 edition, 2013.

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*25%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*25%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	*25%*	-	*30%*	-
Level 4	*Analyze*	*30%*	-	*25%*	-	*30%*	-
Level 5	*Evaluate*	-	-		-	-	-
Level 6	*Create*	-	-		-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Muthukumarasamy S, Capgemini India Pvt Ltd,Chennai	1. Prof .Dr. Deivamani Mallaya, College of Engineering, Guindy, Chennai.	1. Ms.Briskilal J, Computing Technologies, SRMIST,KTR, Chennai.
	2.	2. Ms.Vijayalakshmi M, Computing Technologies, SRMIST,KTR, Chennai.

Course Code	21CSE456T	Course Name	Software Defined Networks	Course Category	E	Professional Elective	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computing Technologies	*Data Book / Codes / Standards*		Nil	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	Learn the fundamentals of software defined networks.
CLR-2 :	Explore different controllers of SDN .
CLR-3 :	Study about the SDN Programming.
CLR-4 :	Analyze the various applications of SDN
CLR-5 :	Express the various components of SDN and their uses

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and society	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Differentiate between traditional and software defined networks	-1	-	-	-	-	2	-	-	-	-	-	-	-	-	-
CO-2:	Associate appropriate Controllers for different applications	-	-1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Obtain skills to do advanced networking research and programming	2	-	*-1*	-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Learn how to use software programs to perform varying and complex networking tasks	-	*3*	-	-	*-1*	-	-	-	-	-	-	-	-	-	-
CO-5:	Explore the knowledge learned and apply it to solve real time problems	-	-1		*3*	-	-	-	-	-	-	-	-	-	-	-

Unit-1 : INTRODUCTION TO SDN 9hrs

Introduction - Evolution of SDN – Need for SDN - Centralized and Distributed Control and Data Planes - The Genesis of SDN Introducing Mininet - Setting up the Environment and Implementation of SDN Aspects in Mininet

Unit-2 : SDN ABSTRACTIONS 9 hrs

Working principle of SDN - Openflow Protocol, SDN Controllers: Introduction - General Concepts - VMware - Nicira - OpenFlow-Related - Mininet - NOX/POX - Trema - Ryu , Floodlight - Layer 3 Centric - Plexxi - Cisco OnePK,Implementation of Custom Topologies in POX, ODL, Floodlight 3 Click, ONOS,Interfacing: Northbound – Southbound and East bound -West bound.

Unit-3: PROGRAMMING Of SDN 9hrs

Network Programmability - Network Function Virtualization - NetApp Development, Network Slicing ,ONOS deployment ONOS – OPNFV

Unit-4 : SDN APPLICATIONS AND USE CASES 9 hrs

SDN in the Data Center - SDN in Other Environments - SDN Applications - SDN Use Cases - The Open Network Operating System 3

Unit-5: SDN'S FUTURE AND PERSPECTIVES 9 hrs

SDN Open Source - SDN Futures – SDN SECURITY- Switching and Load Balancers, Firewall and Access Control, Use cases in Legacy Networks security.

Learning Resources	1. Software Defined Networks: A Comprehensive Approach by Paul Goransson and Chuck Black, Morgan Kaufmann Publications, 2016 Reprint 2. SDN - Software Defined Networks by Thomas D. Nadeau & Ken Gray, O'Reilly, 2013 3. Software Defined Networking with OpenFlow By SiamakAzodolmolky, Packt Publishing, 2013 4. Feamster, Nick, Jennifer Rexford, and Ellen Zegura. "The road to SDN: an intellectual history of programmable networks." ACM SIGCOMM Computer Communication Review 44.2 (2014): 87-98.	

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*15%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*25%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	*30%*	-	*30%*	-
Level 4	*Analyze*	*30%*	-	*30%*	-	*30%*	-
Level 5	*Evaluate*	-	-	-	-	-	-
Level 6	*Create*	-	-	-	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. P.Kumaran,Senior Engineer,CSS Corp , Navalur,Chennai	*1.* Dr. M. Sridevi, Associate Professor, Dept. of CSE, NIT, Trichy	1. Dr.B.Amutha, Prof./CTech/SRMIST
2.D.Dinesh Babu,Servion global solution private limited,Software Engineer,Chennai		*2.* D.Vanusha,Assistant Assistant Prof./CTech/SRMIST *3.* Dr.R.Thamizhamuthu Assistant Prof./CTech/SRMIST

Course Code	21CSE457T	Course Name	Service Oriented Architecture	Course Category	E	*Professional Elective*	L	T	P	C
							2	1	0	3

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Computing Technologies*	*Data Book / Codes / Standards*			

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	To understand the main concepts, principles, needs and evolution of SOA
CLR-2 :	To understand and apply patterns for service design from the provider and requester perspectives
CLR-3 :	To understand SOA challenges mainly regarding governance, testing and maintenance
CLR-4 :	To understand the business case for SOA
CLR-5 :	To Understand the best strategies and practices of SOA

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12			
		Engineering	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and	Environment &	Ethics	Individual & Team	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Comprehend the need for SOA and its systematic evolution.	2	1	1	-	-	-	-	-	-	-	-	-			-
CO-2:	Design and analyze various SOA patterns and techniques.	2	1	1	-	-	-	-	-	-	-	-	-			-
CO-3:	Create a best implementation model	3	2	3			-	-	-	-	-	-	-			-
CO-4:	Apply SOA technologies to enterprise domain	2	1	1			-	-	-	-	-	-	-			-
CO-5:	Implement the best strategies and practices of SOA	3	2	3		-	-	-	-	-	-	-	-			-

Unit-1 : . Introduction

Introduction: SOA and MSA Basics: Service Orientation in Daily Life, Evolution of SOA and MSA. Service oriented Architecture and Microservices architecture – Drivers for SOA, Dimensions of SOA, Conceptual Model of SOA, Standards and Guidelines for SOA, Emergence of MSA

Enterprise-Wide SOA: Considerations for Enterprise-wide SOA, Strawman Architecture for Enterprise-wide SOA, Enterprise SOA Reference Architecture, Object-oriented Analysis and Design (OOAD) Process, Service-oriented Analysis and Design (SOAD) Process, SOA Methodology for Enterprise

Unit-2 : Analysis and Design

Service-Oriented Applications: Considerations for Service-oriented Applications, Patterns for SOA, Pattern-based Architecture for Service-oriented Applications, Composite Applications, Composite Application Programming Model.
Service-Oriented Analysis and Design: Need for Models, Principles of Service Design, Nonfunctional Properties for Services, Design of Activity Services (or Business Services), Design of Data Services, Design of Client Services, Design of Business Process Services

Unit-3: Technologies for SOA

Technologies for SOA: Technologies for Service Enablement, Technologies for Service Integration, Technologies for Service Orchestration.

SOA Governance and Implementation: Strategic Architecture Governance, Service Design-time Governance, Service Run-time Governance, Approach for Enterprise-wide SOA Implementation

Unit-4 : Big Data and SOA

Big Data and SOA: Concepts, Big Data and its characteristics, Technologies for Big Data, Service-orientation for Big Data Solutions.

Business Case for SOA: Stakeholder Objectives, Benefits of SOA, Cost Savings, Return on Investment (ROI), Build a Case for SOA

Unit-5: SOA Best Practices

SOA Best Practices: SOA Strategy – Best Practices, SOA Development – Best Practices, SOA Governance – Best Practices.

EA and SOA for Business and IT Alignment: Enterprise Architecture, Need for Business and It Alignment, EA and SOA for Business and It Alignment

Learning Resources	1. Shankar Kambhampaty; Service - Oriented Architecture & Microservices Architecture: For Enterprise, Cloud, Big Data and Mobile; Wiley; 3rd Edition; 2018; ISBN: 9788126564064. 2. Icon Group International; The 2018-2023 World Outlook for Service-Oriented Architecture (SOA) Software and Services; ICON Group International; 1st Edition, 2017; ASIN: B06WGPN8YD.	3.Thomas Erl; Service Oriented Architecture Concepts Technology & Design; Pearson Education Limited; 2015; ISBN-13: 9788131714904. 4. Guido Schmutz, Peter Welkenbach, Daniel Liebhart; Serrvice Oriented Architecture An Integration Blueprint; Shroff Publishers & Distributors; 2010; ISBN-13: 9789350231081

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*15%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*20%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	*25%*	-	*30%*	-
Level 4	*Analyze*	*30%*	-	*25%*	-	*30%*	-
Level 5	*Evaluate*	-	-	*10%*	-	-	-
Level 6	*Create*	-	-	*5%*	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Umesh Goyal Senior Manager System Engineering - End User Computing at VMware	*1.*	*1.* Dr J Selvin Paul Peter
	2.	*2.*

Course Code	21CSE458T	Course Name	Wireless and Mobile Communication	Course Category	E	Professional Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	*Nil*
Course Offering Department	Computing Technologies	*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, Apply skills in various Routing protocols

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and society	Environment &	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Apply Wireless Technology concepts to Engineering problems related to communication	*1*	*3*	*3*	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Improve their knowledge on Digital and analog Modulation techniques.	*1*	2	*1*	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Equip themselves familiar with principle of Mobile Communication	*1*	*3*	2	-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Familiarize with Digital Cellular Standards	*1*	*1*	*1*	-	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Acquaint with routing protocols, Expose to the emerging wireless technologies	*1*	2	2	-	-	-	-	-	-	-	-	-	-	-	-

Unit-1 : Introduction to wireless communication- Elements of wireless communication system- Frequencies for radio communication- Signals, Noise – Types of Noise- Introduction to modulation and demodulation- Signals in the modulation- Introduction to Analog modulation schemes- Amplitude Modulation Frequency modulation- Phase Modulation Introduction to Analog modulation schemes- Amplitude Shift Keying Frequency Shift Keying Phase Shift Keying- BPSK, QPSK- Multiplexing and multiple access techniques- Frequency-division multiplexing- Time-division multiplexing- Code-division multiplexing- Spread spectrum modulation- frequency hopping Spread spectrum- Direct Sequence Spread spectrum

Unit-2 : Cellular Concept- Cell area- Signal strength- Cell parameter- Capacity of Cell- Co channel interference- Frequency reuse- Frequency reuse- Multiple Radio access protocols Frequencydivision Multiple Access- Multiple Radio access protocols Frequencydivision Multiple Access- Multiple Access with Collision Avoidance- Space division Multiple Access Code division Multiple Access- Space division Multiple Access Code division Multiple Access- OFDM- Variants of OFDM- Comparison of Multiple Access Technique

Unit-3: Introduction to GSM- Frequency Bands and Channels- Frames in GSM- Planes and layers of GSM- Protocols- Localization and calling- Handoff – Short messaging system- GPRS EDGE- 3G CELLULAR SystemsMMS- 3G CELLULAR SystemsMMS- Handover- Satellite System Infrastructure- GEO, LEO, MEO- Limitations of GPS- GPSBeneficiaries of GPS- 4G Cellular systems- 4G Standards (LTE/WiMax)

Unit-4 : Mobile IP- IP packet delivery- Tunneling – Reverse Tunneling- IPv6- DHCP- Tradition TCP- Congestion control- Classical TCP Snooping- Mobile TCPFast retransmit / Fast recovery- Transaction oriented TCP TCP over 2.5/3G wireless Networks-

Introduction to WAP WAP Architecture- Wireless Datagram ProtocolWireless Transaction Protocol- Wireless Session Protocol- Wireless Transport Layer Security- Wireless Markup Language- Push Architecture
Unit-5: System Architecture- Protocol Architecture- MAC Layer and Management- 802.11a, 802.11b- HIPERLAN- Bluetooth Architecture- IEEE 802.15 IEEE 802.15.4-MANET characteristicsROUTING- AODV Routing VANETCommunications in VANET- Wireless Sensor Networks- RFID TechnologyTwo tags of RFID- Wi-Fi Standards- WiMax Standards- Fem-to-Cell Network- 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. G.I.Papadimitriou, A.S.Pomportsis, P.Nicopolitids, M.S.Obaidat, "Wireless Networks", John Wiley and Sons, 2003 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 (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*15%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*20%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	*25%*	-	*30%*	-
Level 4	*Analyze*	*30%*	-	*25%*	-	*30%*	-
Level 5	*Evaluate*	-	-	*10%*	-	-	-
Level 6	*Create*	-	-	*5%*	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
	1. Dr.V.Kavitha Associate professor,Kings Engineering college.Anna University.chennai	1. Dr.V.Deeban Chakravarthy
	2. Dr.Kadiyala Ramana,Associate professor,Chaitanya bharathi Institute of Technology,Osmania University.Hyderabad.	2. Dr.P.Kirubanantham

Course Code	21CSE459T	Course Name	WIRELESS SENSOR NETWORKS	Course Category		Professional Elective	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nill	Co- requisite Courses	Nill	Progressive Courses	Nill
Course Offering Department	Computing Technologies	*Data Book / Codes / Standards*			

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	Understand the basic sensor network concepts
CLR-2 :	Learn about various Medium Access Control Protocols
CLR-3 :	Comprehend the strategies of various routing Protocols
CLR-4 :	Gain the knowledge on Localization and Time Synchronization
CLR-5 :	Understand the concept of Middleware Services and Network Security

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific outcomes		
		1 Engineering	2 Problem Analysis	3 Design/development of solutions	4 Conduct investigations of complex problems	5 Modern Tool Usage	6 The engineer and	7 Environment &	8 Ethics	9 Individual & Team	10 Communication	11 Project Mgt. & Finance	12 Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	To list out the challenges of WSN	*1*	*3*	*3*	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	To Analyze the variation in different protocols and apply in real time scenario	*1*	*2*	*1*	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	To identify the best Routing Strategies	*1*	*3*	*2*	-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	To Apply and Analyze the importance of various Localization and Time Synchronization	*1*	*1*	*1*	-	-	-	-	-	-	-	-	-	-	-	-
CO-5:	To implement an application using middleware architecture with advanced security features	*1*	*2*	*2*	-	-	-	-	-	-	-	-	-	-	-	-

Unit-1 : Introduction to Wireless Sensor Netwoks
Motivation for a network of Wireless
Sensor nodes - Sensing and sensors- Challenges and constraints- Node architecture- Sensing sub system- Processor sub system- Communication interfaces-- prototypes- Application of Wireless sensors- WSN Tools- Overview and Limitations- Contiki -Introduction- Characteristics of Contiki WSN simulator- Sensor Network Programming- Challenges in Sensor Network Programming- Node-Centric Programming

Unit-2 : Mac Protocols for WSN- Characteristics of MAC protocols in Sensor networks- Contention free MAC Protocols- MAC Protocols –Characteristics- Traffic Adaptive Medium Access- Y-MAC- Low energy Adaptive Clustering- Contention based MAC Protocols- Sensor MAC- Timeout MAC and pattern MAC- Hybrid MAC Protocol- MAC protocols in ContikiOS simulator- Nullmac in Contiki simulator

Unit-3: Routing Strategies- Routing Metrics- Flooding and Gossiping- Data-Centric Routing- Proactive Routing- On-Demand Routing- Hierarchical Routing- Location-Based Routing- QoS-Based Routing Protocols- Local Power Management Aspects- Dynamic Power Management

Unit-4 : Localization and Time Synchronization - Clocks and the Synchronization Problem- Time Synchronization in Wireless Sensor Networks- Basics of Time Synchronization- Time Synchronization Protocols- Ranging Techniques- Range-Based Localization- Range-Free Localization- Event-Driven Localization

Unit-5: WSN Security and Middleware Services- Fundamentals of Network Security- Challenges of Security in Wireless Sensor Networks- Security Attacks in Sensor Networks- Protocols and Mechanisms for Security- Middleware Architecture- Data related functions,Architecture- Existing middleware- MiLAN,IrisNet- AMF,DSWare- CLMF

Learning Resources	1.Waltenegus Dargie, Christian Poellabauer , ―Fundamentals of Wireless Sensor Networks, Theory and Practice‖, Wiley Series on wireless Communication and Mobile Computing, 2011 2.Kazem Sohraby, Daniel manoli , ―Wireless Sensor networks- Technology, Protocols and Applications‖, Wiley InterScience Publications 2013. 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 (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*15%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*20%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	*25%*	-	*30%*	-
Level 4	*Analyze*	*30%*	-	*25%*	-	*30%*	-
Level 5	*Evaluate*	-	-	*10%*	-	-	-
Level 6	*Create*	-	-	*5%*	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr.J.Shelton Samson Vedharaj *Head of Global Software Application Support* *Digital and Technology* *Coats*	*Dr. N. Radha,* *SSN College of Engineering,*	*P.Renukadevi AP/CTech ,SRMIST,KTR* *R.Brindha AP/Ctech SRMIST,KTR*
	Dr.N.Poongavanam *Veltech Rangarajan Dr.Sagunthala R & D Institute of Science and Technology,*	

Course Code	21CSE460T	Course Name	Network Protocols and Algorithms	Course Category	E	Professional Elective	L	T	P	C
							2	1	0	3

Pre-requisite Courses	NIL	Co- requisite Courses	NIL	Progressive Courses	Nil
Course Offering Department	Computer Technologies	*Data Book / Codes / Standards*			

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	Understand the layered architecture for communication networks and the specific functionality of the network layer.
CLR-2 :	Gain knowledge on the need for network protocols, its functionality and different architectures.
CLR-3 :	Understand fundamental basis of various algorithms in centralized and distributed point of view.
CLR-4 :	Understand the various types of key routing protocols used in wireless networks.
CLR-5 :	Gain knowledge on past experiences and prepare for next generation networks and routing

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and society	Environment &	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Acquire the knowledge of conventional networks routing operations	1	2		-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	Comprehend Router Architectures and IP Address Lookup Algorithms	2	1		-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Model and evaluate various routing techniques and protocols	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Examine how different dimensions of routing differ for different types of networks		2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO-5:	Analyze and evaluate various routing paradigms in next generation	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-

Unit-1 : INTRODUCTION
ISO OSI Layer Architecture, TCP/IP Layer Architecture, Functions of Network layer, General Classification of routing, Routing in telephone networks, Dynamic Non hierarchical Routing (DNHR), Trunk status map routing (TSMR), real-time network routing (RTNR), Distance vector routing, Link state routing, Hierarchical routing

Unit-2 TCP/IPPROTOCOLS
BOOTP, DHCP, DNS, Finger, FTP, HTTP, S-HTTP, IMAP and IMAP4, MIME (S-MIME), NAT, NNTP, POP and POP3, rlogin, RMON, SLP, SMTP, SNMP, SNMPv1, SNMPv2, SNMPv3, SNTP, TELNET, URL, Whois (and RWhois), XMPP, X Window/X Protocol, RPC, ITOT, RDP, RUDP, TCP, UDP, BGP (BGP4),

Unit-3: `LAN PROTOCOLS.
LAN Protocols: Ethernet: IEEE 802.3 Local Area Network protocols – Fast Ethernet: 100Mbps Ethernet (IEEE 802.3u)- Gigabit (1000 Mbps) Ethernet:IEEE 802.3z (1000Base-X) and 802.3ab (1000Base-T)- 10-Gigabit Ethernet: IEEE 802.3ae and 802.3an – WLAN: Wireless LAN byIEEE 802.11 protocols – IEEE 802.11i: WLAN Security Standard – IEEE 802.1X: EAP over LAN(EAPOL) for LAN/WLAN Authentication and Key Management – WPAN: Wireless Personal Area Network Communication Protocols – IEEE 802.15.1 and the Bluetooth for WPAN Communications – FDDI: Fiber Distributed Data Interface – Token Ring: IEEE 802.5 LAN Protocol – LLC: Logic Link Control (IEEE 802.2)- SNAP: SubNetwork Access Protocol – STP: Spanning Tree Protocol (IEEE 802.1D).

Unit-4 : **WAN PROTOCOLS**
WAN Protocols: ATM: Asynchronous Transfer Mode Reference Model and Protocols -SONET/SDH: Synchronous Optical Network and Synchronous Digital Hierarchy – EoS: Ethernet over SONET/SDH – BISDN: Broadband Integrated Services Digital Network (Broadband ISDN) -ISDN: Integrated Services Digital Network – PPP: Point-to-Point Protocols – FTP: File Transfer Protocol – PAP: Password Authentication Protocol – PoS:

Unit-5: **Network Security Technologies and Protocols** Kerberos: Network Authentication Protocol – RADIUS: Remote Authentication Dial In User Service – SSH: Secure Shell Protocol – L2F: Layer 2 Forwarding Protocol – L2TP: Layer 2 Tunneling Protocol – PPTP: Point-to-Point Tunneling Protocol – DiffServ: Differentiated Service Architecture – GRE: Generic Routing Encapsulation – IPsec: Internet Protocol Security Architecture – IPsec AH: IPsec Authentication Header – IPsec ESP: IPsec Encapsulating Security Payload – IPsec IKE: Internet Key Exchange Protocol – IPsec ISAKMP:

Learning Resources	1.Jielin Dong, Network Protocols Handbook, 4th Edition, Javvin Press, 2007 2.Bruce Hartpence, Packet Guide to Core Network Protocols, OReilly Media, Inc., 2011. 3.Walter Y. Chen, Home Network Basis: Transmission Environments and Wired/Wireless Protocols, Prentice Hall, 2003. 4.Ana Minaburo , Laurent Toutain, Local Networks and the Internet: From Protocols to Interconnection, John Wiley and Sons, 2011	

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*15%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*20%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	*25%*	-	*30%*	-
Level 4	*Analyze*	*30%*	-	*25%*	-	*30%*	-
Level 5	*Evaluate*	-	-	*10%*	-	-	-
Level 6	*Create*	-	-	*5%*	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. AmarendraMohanty, AdvantagePro 2. Mr. Saju G Nair, Senior Development Manager Kyndryl India Pvt Ltd.	1. Dr.Pradheepkumar, BITS, PILANI	1. Dr.S.Nagadevi, Assistant Professor, CTECH, SRM IST
	2. Dr. P. Varalakshmi, Professor, MIT, AnnaUniversity, Chennai	2. Dr.R.Vidhya, Assistant Professor, CTECH, SRM IST

Open Electives

Course Code	21CSO351T	Course Name	Web Programming	Course Category	O	Open Elective	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computing Technologies	*Data Book / Codes / Standards*	Nil		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	Understand the concepts of WEB Basics and Design
CLR-2 :	Knowledge with Basics of HTML and CSS Structure
CLR-3 :	Demonstrate the client side scripting using JavaScript
CLR-4 :	Execution of Server Side Programming with PHP
CLR-5 :	Create Database programming with PHP and MySQL and Advanced Web Programming concepts

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and society	Environment &	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Use the various HTML tags with appropriate styles to display the various types of contents effectively	1	-	3	-	-	-	-	-	-	-	-	-	-	2	-
CO-2:	Develop the dynamic web pages using HTML, CSS and JavaScript applying web design principles to make pages effective.		-	3	-	2	-	-	-	-	-	-	-	-	2	-
CO-3:	Design the client side scripts using various features for creating customized web services	1	-	3	-	2	-	-	-	-	-	-	-	-	2	-
CO-4:	Develop the server side PHP scripts using various features for creating customized web services.	1	2	3	-	2	-	-	-	-	-	-	-	-	2	2
CO-5:	Create the server side scripts for designing web based services with database connectivity and develop a web application using advanced web programming concepts.		1	3	-	2	-	-	-	-	-	-	-	-	2	2

Unit-1 : Introduction to WEB, Basics of WWW, HTTP protocol, Client Server architecture, Introduction to web server installation and configuration
Web Design Concepts of effective web design, Web design issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Website, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation

Unit-2 : Basics of HTML and CSS, Structure of HTML page, HTML tags for data formatting, tables, links, images, meta tags, frames, html form tags, media, APIs, HTML5 tags and validation. Need for CSS, Syntax and structure, CSS rules for Backgrounds, Colors and properties, Manipulating texts, Fonts, borders and boxes, Margins, Padding Lists, CSS Positioning. Animations, Tool-Tips, Style images, Variables, Media Queries, Wildcard Selectors (*, ^ and $) in CSS, Working with Gradients, Pseudo Class and Pseudo elements

Unit-3: Client Side Scripting using JavaScript Syntax of JavaScript, Execution of JavaScript, Internal, Embedded and External JavaScript, JavaScript : variables, arrays, functions, conditions, loops, Pop up boxes, JavaScript objects and DOM, JavaScript inbuilt functions, JavaScript validations and Regular expressions, Event handling with JavaScript.

Unit-4 : Server Side Programming with PHP Difference between Client side and Server side scripting, Structure of PHP page, PHP Syntax: variables, decision and looping with examples, PHP and HTML, Arrays and Functions, String, Form processing, File uploads, Dates and time zone, Working with Regular Expressions, Exception Handling.

Unit-5: Database programming with PHP and MySQL Basic MySQL commands, PHP functions for database connectivity, Implementation of CRUD operations using PHP, Prepared Statement and stored procedure execution in PHP, Advanced Web Programming concepts, Asynchronous Web Programming, Difference between synchronous and asynchronous web programming.

Learning Resources	1. Web Technology, Moseley and Savaliya, Wiley India 2016 2. HTML 5 Black Book 2Ed, Kogent Learning Solutions Inc, dreamtech 2016 3. Web Design, Joel Sklar, Cengage Learning 2015 4. Learning PHP, MySQL, JavaScript, CSS & HTML5, 3rd Edition, Robin Nixon, O'Reilly 2014	5. A Step-by-Step Guide to Creating Dynamic Websites By Robin Nixon Publisher: O'Reilly Media 2021 6. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel, Pearson, 5th edition, 2014 7. JavaScript for impatient programmers, Dr. Axel Rauschmayer 2022 8. PHP: The Complete Reference By Steven Holzner, McGrawhill, 2017

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*15%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*30%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	*30%*	-	*30%*	-
Level 4	*Analyze*	*30%*	-	*25%*	-	*30%*	-
Level 5	*Evaluate*	-	-		-	-	-
Level 6	*Create*	-	-		-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
K.Sankar Chief Data Scientist - AI, ML and Computer Vision. Eagle Software India Pvt Ltd. Greams Road, Chennai - 600006. Mob : 7305926073	Dr. K. Veningston Assistant Professor, Department of Computer Science and Engineering, National Institute of Technology Srinagar, Hazratbal - 190006, Jammu and Kashmir. Contact: +91 9790278826	Dr.S.Babu Associate Professor Department of Computing Technologies SEMIST Kattankulathur.

Course Code	21CSO352T	Course Name	PYTHON PROGRAMMING	Course Category	O	Open Elective	L	T	P	C
							2	1	0	3

Pre-requisite Courses	nill	Co- requisite Courses		Progressive Courses	
Course Offering Department	Computing Technologies	*Data Book / Codes / Standards*			

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	Understand the basic programming syntax of Python
CLR-2 :	Understand various Looping statements and Functions
CLR-3 :	Acquire the Knowledge of Object Oriented Feature in Python
CLR-4 :	Comprehend the significance of Lists, Sets and Tuples in Program Development
CLR-5 :	Acquire the knowledge of Files and handling Exceptions

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific outcomes		
		1 Engineering	2 Problem Analysis	3 Design/development of solutions	4 Conduct investigations of	5 Modern Tool Usage	6 The engineer and	7 Environment &	8 Ethics	9 Individual & Team	10 Communication	11 Project Mgt. &	12 Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Apply the basic programming knowledge for Program Development	-1	3	-	-	-3	-	-	-	-	-	-	-	2	-	-
CO-2:	Apply the knowledge of Loops and Functions to build application	-1	-2	-3	-	-	-	-	-	-	-	-	-	-	2	-
CO-3:	Design of real world application using Object oriented features	-1	-3	-3	-	-	-	-	-	-	-	-	-	-	2	-
CO-4:	Apply the concepts of Lists and Tuples for program optimization	-1	-3	-3	-	-	-	-	-	-	-	-	-	-	-	1
CO-5:	Design of Applications for data exchange using Files	-1	-	-3	-	-2	-	-	-	-	-	-	-	-	-	1

Unit-1 : INTRODUCTION

Introduction - History of Python-Getting Started with Python-Programming style and Documentation-Identifiers-Variables-Assignment statements-Expressions- Data Types-Operators-Precedence-Comments-Type Conversions-Common Python Functions-Introduction to Methods and Strings

Unit-2 : LOOPS AND FUNCTIONS

Introduction-Scope-IF Statements-Types of IF Statements-Conditional Expressions-Loops -While Loops-For Loop-Nested Loops-Functions-Definitions-Default Arguments-Calling a Function- Functions with or without returning values-Passings arguments to a function-Call by Value - Call by Reference-Recursion

Unit-3: CLASSES AND OBJECTS

Introduction to Object oriented Programming-Need of class and objects-Defining classes-Constructing Objects-Abstraction and Encapsulation-Overriding Methods - Inheritance and Polymorphism-Modules and Packages-Introduction to String Class-String Functions-Formatting Strings

Unit-4 : LISTS - TUPLES-SETS

Introduction to Lists-Creation of List-Functions for Lists-Passing List to Functions-Operation on Lists-Searching and Sorting-Multidimensional Lists-Advanced List Processing - Sample programs on Lists-Lotto number and Deck of Cards-Introduction to Tuples-Sets - Creation and Accessing Sets-Dictionary Operations and Methods

Unit-5: FILES AND EXCEPTION HANDLING

Introduction - Structure of File - Opening and Writing Data-Accessing Files-File Dialogs-Retrieving data from web-Introduction to Exceptions-Errors and Exceptions-Command line arguments-Need for Exception-Handling Exceptions-Raising Exceptions-Exception Objects-Custom Exception Classes

Learning Resources

1. Y.Daniel Liang, "Introduction to Programming using Python"1st edition, Pearson,2021,
2. [Karl Beecher, "Computational Thinking-A beginners guide to problem solving and programming, 2017]
3. [Allen Downey, "Think Python - How to Think Like a Computer Scientist, Green Tea Press, 2021

Learning Assessment							
	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*15%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*25%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	30%	-	*30%*	-
Level 4	*Analyze*	*30%*	-	30%	-	*30%*	-
Level 5	*Evaluate*	-	-		-	-	-
Level 6	*Create*	-	-		-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr. D. Surendran, CEO, SKS Skill Fasteners Private limited	Dr. Kannimuthu.S, Professor, Karpagam College of Engineering,Coimbatore	Dr. P. Madhavan,SRMIST

Course Code	21CSO353T	Course Name	MOBILE APPLICATION DEVELOPMENT	Course Category	O	Open Elective	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nill	Co- requisite Courses	Nill	Progressive Courses	Nill
Course Offering Department	Computing Technologies	*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 GUI Components in Android programming
CLR-3 :	Analyze Data storage mechanism in different Android App
CLR-4 :	Appraise android services for different applications
CLR-5 :	Design and apply the knowledge to publish Android applications

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and	Environment &	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Exhibit the knowledge on Android devices and Platform	1	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO-2:	Demonstrate the usage of GUI Components for App development.	1	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	Decide on suitable Data storage mechanism for Apps	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	Implement Android services using threads	1	-	3	-	3	-	-	-	-	-	-	-	-	-	-
CO-5:	Develop and publish Android applications	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-

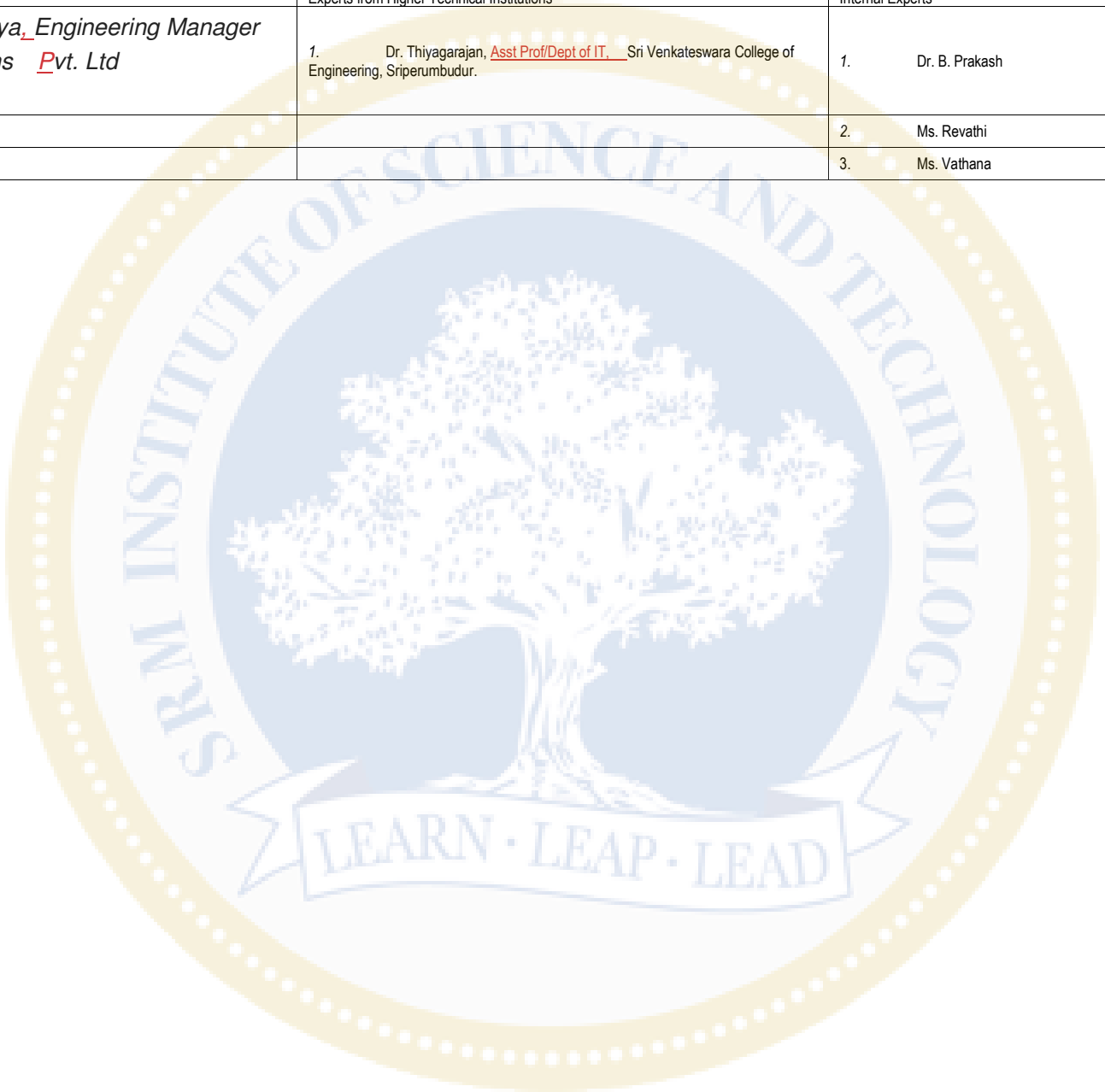
Unit-1 : Introduction to Mobile Application Development: Introduction, Android platform: Features and architecture, versions, ART (Android Runtime), ADB(Android Debug Bridge). Development environment/IDE: Android studio and its working environment, Application anatomy: Application framework basics: resources layout, values, asset XML representation and generated R.Javafile, Android manifest file. Creating a simple application.
Unit-2 : GUI for Android: Introduction to activities life-cycle, intent filters, adding categories, linking activities, user interface design components, Views and View Groups: Basic views, picker views, adapter views, Menu, App Bar, basics of screen design; different layouts, App widgets. Lollipop Material design: new themes, new widgets, Card layouts. Recycler View, Fragments: Introduction to Fragments, life-cycle.
Unit-3:Memory Management: Introduction to Different Data persistence schemes, Shared preferences, File Handling, Managing data using SQLite database. Content providers: user content provider, Android in-built content providers, Integration of Social media apps.
Unit-4 : Threads and Android Services: introduction to services – local service, remote service and binding the service, the communication between service and activity, Intent Service, Multi-Threading: Handlers, Async Task, android network programming: HttpUrl Connection, Connecting to REST-based and SOAP based Web services, Broadcast receivers: Local Broadcast Manager, Dynamic broadcast receiver, System Broadcast. Pending Intent, Notifications, Telephony Manager: Sending SMS and making calls, Interaction with server side apps
Unit-5: Building android Applications: Introduction to Location based services, Google maps V2 services using Google API.Animations and Graphics: Property Animation, View Animations, Drawable Animations, Media and Camera API: Working with video and audio inputs, Camera API, Sensor programming: Motion sensors, Position sensors, Environmental sensors, Guide lines, policies and process of uploading Apps to Google play

Learning Resources	1. Dawn Griffiths, David Griffiths, "Head First: Android Development" ,OReilly 2015, ISBN:9781449362188. 2. Greg Milette, Adam Stroud, "PROFESSIONAL Android™ Sensor Programming", John Wiley and Sons, Inc 2012,ISBN/978111265055,9781280678943,978111227459	3. PaulDeital, Harvey Deital, AlexanderWald, "Android6 for Programmers, App Drivenapproach",2015, Prentice Hall ,ISBN:9780134289366. 4. http://developer.android.com/training/index.html

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*15%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*20%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	30%	-	*30%*	-
Level 4	*Analyze*	*30%*	-	30%	-	*30%*	-
Level 5	*Evaluate*	-	-	-	-	-	-
Level 6	*Create*	-	-	-	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mrs. C.Saranya, Engineering Manager embedUR systems Pvt. Ltd Chennai.	*1.* Dr. Thiyagarajan, Asst Prof/Dept of IT, Sri Venkateswara College of Engineering, Sriperumbudur.	*1.* Dr. B. Prakash
		2. Ms. Revathi
		3. Ms. Vathana



Course Code	21CSO354T	Course Name	Data Analytics	Course Category	O	Open Elective	L	T	P	C
							2	1	0	3

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Computing Technologies*	*Data Book / Codes / Standards*			

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	Understand the basic concepts of Data Analytics
CLR-2 :	Share knowledge of Data Analytics techniques
CLR-3 :	Explore the concept of visualization and its tools
CLR-4 :	Explore and apply the machine learning techniques
CLR-5 :	Implement the applications of Data analytics in different domains

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific outcomes		
		1 Engineering Knowledge	2 Problem Analysis	3 Design/development of solutions	4 Conduct investigations of complex problems	5 Modern Tool Usage	6 The engineer and society	7 Environment &	8 Ethics	9 Individual & Team Work	10 Communication	11 Project Mgt. & Finance	12 Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Exhibit knowledge on the fundamental concepts of data analytics	1	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO-2:	Suggest suitable data analysis techniques to handle large data	1	2	3	-	-	-	-	-	-	-	-	-	2	-	-
CO-3:	Create an interactive dashboard to visualize data	-	1	2	-	3	-	-	-	-	-	-	-	2	-	-
CO-4:	Apply appropriate machine learning algorithm to perform data analytics	1	2	-	3	-	-	-	-	-	-	-	-	2	-	-
CO-5:	Develop intelligent decision support systems	-	1	2	-	3	-	-	-	-	-	-	-	2	-	-

Unit-1 : Introduction to Data Analytics - Types – Phases - Quality and Quantity of data – Measurement - Exploratory data analysis - Analytic Processes and Tools
Unit-2 : Big Data and Cloud technologies - Streams Concepts – Stream Data Model and Architecture - Introduction to HADOOP: Big Data, Apache Hadoop, MapReduce - Data Serialization - Data Extraction
Unit-3: Introduction to data visualization – Data visualization options – Filters – Dashboard development tools – Creating an interactive dashboard with dc.js - summary.
Unit-4 : Machine learning – Modeling Process – Training model – Validating model – Predicting new observations –Supervised learning algorithms – Unsupervised learning algorithms
Unit-5: Case studies and projects Understanding business scenarios- Scalable and parallel computing with Hadoop and Map-Reduce- Feature engineering and visualization

Learning Resources	1. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Introducing Data Science, Manning Publications Co., 1st edition, 2016. 2. Hadoop: The Definitive Guide, 4th Edition [Book] - O'Reilly	3. Data Analytics Made Accessible: 2023, Kindle Edition 4. https://www.amazon.in/Data-Analytics-Made-Accessible-2018-ebook/dp/B00K2I2JL8

Learning Assessment							
	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life Long Learning CLA-2 – (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*15%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*20%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	*25%*	-	*30%*	-
Level 4	*Analyze*	*30%*	-	*25%*	-	*30%*	-
Level 5	*Evaluate*	-	-	*10%*	-	-	-
Level 6	*Create*	-	-	*5%*	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

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