SONA COLLEGE OF TECHNOLOGY, SALEM-5

(An Autonomous Institution)

M.E- Computer Science and Engineering

(Dept of CSE)

CURRICULUM and SYLLABI

[For students admitted in 2024-2025]

PG Regulations 2023

Approved by BOS and Academic Council meetings

CSE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for M.E/M.Tech. Semester I under Regulations 2023 (CBCS)
Branch: M.E Computer Science and Engineering

S.No	Course Code	Course Title	L	T	P	J	C	Category	Total Contact Hours	Course Type*
		Theory courses								
1.	P23MAT101A	Mathematical Foundations of Computer Science	3	1	0	0	4	FC	60	TT
2.	P23CSE101	Advanced Data Structures and Algorithms	3	0	0	0	3	PC	45	T
3.	P23CSE102	Advanced Computer Architecture	3	0	0	0	3	PC	45	T
4.	P23CSE103	Advanced Operating Systems	3	0	0	0	3	PC	45	T
5.	P23GE101	Research Methodology and IPR	3	0	0	0	3	PC	45	T
6.	P23GE702	**Audit Course:** Stress Management by Yoga	2	0	0	0	0	AC	30	T
		Practical courses								
7	P23CSE104	Advanced Data Structures and Algorithms Laboratory	0	0	2	2	2	PC	60	LP
8	P23CSE105	Advanced Operating Systems laboratory	0	0	2	2	2	PC	60	LP
		Total Credits					**20**			

*T- Theory, TT- Theory with Tutorial, TL- Theory with Laboratory,TP- Theory with Project, TLP- Theory with Laboratory and Project, L- Laboratory, LT- Laboratory with Theory, LP- Laboratory with Project

Approved By

Chairperson, CSE BoS	Member Secretary, Academic Council	Dean-Academics	Chairperson, Academic Council & Principal
Dr B.Sathiyabhama	Dr.R.Shivakumar	Dr.J.Akilandeswari	Dr.S.R.R.Senthil Kumar

Copy to:-

HOD/ Computer Science and Engineering, First Semester M.E. CSE Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for M.E/M.Tech. Semester II under Regulations 2023 (CBCS)
Branch: Computer Science and Engineering

S.No	Course Code	Course Title	L	T	P	J	C	Category	Total Contact Hours	Course Type*
Theory courses										
1.	P23CSE201	Advanced Databases	3	0	0	0	3	PC	45	T
2.	P23CSE202	Advanced Network Design	3	0	0	0	3	PC	45	T
3.	P23CSE522	**Elective:** Software Testing and Quality Assurance	3	0	0	0	3	PE	45	T
4.	P23CSE525	**Elective:** Foundations of Data Science	3	0	0	0	3	PE	45	T
5.	P23CSE535	**Elective:** Healthcare Data Analytics	3	0	0	0	3	PE	45	T
6.	P23GE701	**Audit Course:** English for Research Paper Writing	2	0	0	0	0	AC	30	T
Practical courses										
7.	P23CSE203	Advanced Databases Laboratory	0	0	2	2	2	PC	60	LP
8.	P23CSE204	Advanced Network Design Laboratory	0	0	2	2	2	PC	60	LP
						Total Credits	19			

*T- Theory, TT- Theory with Tutorial, TL- Theory with Laboratory, TP- Theory with Project, TLP- Theory with Laboratory and Project, L-Laboratory, LT- Laboratory with Theory, LP- Laboratory with Project

Approved By

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Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for M.E/M.Tech. Semester III under Regulations 2023 (CBCS)
Branch: Computer Science and Engineering

S.No	Course Code	Course Title	L	T	P	J	C	Category	Total Contact Hours	Course Type*
Theory courses										
1.	P23CSE512	**Elective:** Information Retrieval	3	0	0	0	3	PE	45	T
2.	P23CSE518	**Elective:** Software Security	3	0	0	0	3	PE	45	T
3.	P23CSE524	**Elective:** Visualization Techniques	3	0	0	0	3	PE	45	T
Practical courses										
4.	P23CSE301	Project Work -I	0	0	0	16	08	PC	240	P
						Total Credits	**17**			

*T- Theory, TT- Theory with Tutorial, TL- Theory with Laboratory, TP- Theory with Project, TLP- Theory with Laboratory and Project, L-Laboratory, LT- Laboratory with Theory, LP- Laboratory with Project, P- Project.

Approved By

Chairperson -- CSE BoS	**Member Secretary/ Academic Council**	**Dean-Academics**	**Chairperson, Academic Council & Principal**
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Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for M.E/M.Tech. Semester IV under Regulations 2023 (CBCS)
Branch: Computer Science and Engineering

S.No	Course Code	Course Title	L	T	P	J	C	Category	Total Contact Hours	Course Type*
Practical courses										
1.	P23CSE401	Project Work-II	0	0	0	28	14	PC	420	P
						Total Credits	14			

*T- Theory, TT- Theory with Tutorial, TL- Theory with Laboratory, TP- Theory with Project, TLP- Theory with Laboratory and Project, L-Laboratory, LT- Laboratory with Theory, LP- Laboratory with Project

Approved By

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CSE

Sona College of Technology, Salem

(An Autonomous Institution)

Courses of Study for M.E/M.Tech. Semester I under Regulations 2023 (CBCS)

Branch: M.E Computer Science and Engineering

S.No	Course Code	Course Title	L	T	P	J	C	Category	Total Contact Hours	Course Type*
		Theory courses								
1.	P23MAT101A	Mathematical Foundations of Computer Science	3	1	0	0	4	FC	60	TT
2.	P23CSE101	Advanced Data Structures and Algorithms	3	0	0	0	3	PC	45	T
3.	P23CSE102	Advanced Computer Architecture	3	0	0	0	3	PC	45	T
4.	P23CSE103	Advanced Operating Systems	3	0	0	0	3	PC	45	T
5.	P23GE101	Research Methodology and IPR	3	0	0	0	3	PC	45	T
6.	P23GE702	**Audit Course:** Stress Management by Yoga	2	0	0	0	0	AC	30	T
		Practical courses								
7	P23CSE104	Advanced Data Structures and Algorithms Laboratory	0	0	2	2	2	PC	60	LP
8	P23CSE105	Advanced Operating Systems laboratory	0	0	2	2	2	PC	60	LP
		Total Credits					**20**			

*T- Theory, TT- Theory with Tutorial, TL- Theory with Laboratory,TP- Theory with Project, TLP- Theory with Laboratory and Project, L- Laboratory, LT- Laboratory with Theory, LP- Laboratory with Project

Approved By

Chairperson, CSE BoS	**Member Secretary, Academic Council**	**Dean-Academics**	**Chairperson, Academic Council & Principal**
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COMPUTER SCIENCE AND ENGINEERING						
M. E. / COMPUTER SCIENCE AND ENGINEERING						
SEMESTER - I	MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE	L	T	P	J	C
P23MAT101A		3	1	0	0	4

Course Outcomes

At the end of the course, the student will be able to

CO1:	apply the concept of set theory in machine learning, databases, class-based object-oriented systems and data structures.
CO2:	apply the concept of logical theory to validate the correctness of software specifications.
CO3:	analyse the computational processes using combinatorial techniques.
CO4:	apply the concept of automata, formal languages and turing machines in text processing, compilers, hardware design, programming languages and artificial intelligence.
CO5:	apply the concept of graph theory in networks of communication, data organization, computational devices and the flow of computation.

Pre-requisites:

- Basics of elementary algebra
- Basics of calculus
- Basics of geometry
- Basics of discrete mathematics

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	3	3
CO2	3	3	2	3	3
CO3	3	3	2	3	3
CO4	3	3	2	3	3
CO5	3	3	2	3	3

Course assessment methods [Theory]

Direct		Indirect
CIE test I (10) (Theory) CIE test II (10) (Theory) CIE test III (10) (Theory) Assignment / Problem- solving / Seminar (10)	Total CIE: 40 marks Semester End Examination: 60 marks	Course end survey

Unit 01	FUNDAMENTAL STRUCTURES	12 Hours

Set theory – relationships between sets – operations on sets – set identities – principle of inclusion and exclusion – relations – binary relations – partial orderings – equivalence relations.

Unit 02	LOGIC	12 Hours

Propositional logic – logical connectives – truth tables – normal forms (conjunctive and disjunctive) – proof techniques – direct – proof by contradiction – proof by reduction.

Unit 03	COMBINATORICS	12 Hours
Sum-rule – product-rule – permutations – combinations – mathematical induction – Pigeon-hole principle – principle of inclusion-exclusion – recurrence relations – generating functions.		
Unit 04	MODELING COMPUTATIONAND LANGUAGES	12 Hours
Finite state machines – deterministic and non-deterministic finite state machines – formal languages – classes of grammars – context sensitive – context free – regular grammars.		
Unit 05	GRAPHS	12 Hours
Introduction to graphs – graph terminology – representation of graphs – graph isomorphism – connectivity – Euler and Hamilton Paths – shortest path algorithms – spanning trees – minimum spanning tree.		

Theory: 45 Hrs	Tutorial: - 15 Hrs	Practical:	Project:-	Total Hours: 60 Hrs

TEXT BOOK:

1. J. P. Trembley and R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science" McGraw Hill Publishers, 1st Edition 2017.

REFERENCE BOOKS:

1. K. H. Rosen, "Discrete Mathematics and its Applications", McGraw Hill Publishers, 8th Edition, 2019.
2. R. P. Grimaldi, "Discrete and Combinatorial Mathematics", Pearson Publishers, 5th Edition, 2006.
3. T. Veerarajan, "Discrete Mathematics", McGraw Hill Publishers, 13th Reprint 2011.

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BoS – Chairperson / Science and Humanities

P23CSE101	ADVANCED DATA STRUCTURES AND ALGORITHMS	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

At the end of the course, the student will be able to

CO1:	Design algorithms to solve real-time problems
CO2:	Design and develop algorithms using various hierarchical data structures
CO3:	Develop Graph algorithms to solve real-life problems
CO4:	Apply suitable design strategy for problem solving
CO5:	Analyse various NP hard and NP complete problems

Pre-requisite:

CO/PO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	1	3	1	1	2
CO2	1	1	2	2	1
CO3	1	3	2	3	2
CO4	1	2	2	3	2
CO5	1	2	2	3	2

Course Assessment methods

Direct		Indirect
CIE test I (10) CIE test II (10) CIE test III (10)	Assignment / Problem-solving / Seminar (10) Total CIE: 40 marks Semester End Examination: 60 marks	Course end survey

Unit 01: ROLE OF ALGORITHMS IN COMPUTING — **9 Hours**

Algorithms – Algorithms as a Technology- Insertion Sort – Analyzing Algorithms – Designing Algorithms- Growth of Functions: Asymptotic Notation – Standard Notations and Common Functions- Recurrences: The Substitution Method – The Recursion-Tree Method

Unit 02: HIERARCHICAL DATA STRUCTURES — **9 Hours**

Binary Search Trees: Basics – Querying a Binary search tree – Insertion and Deletion- Red-Black trees: Properties of Red-Black Trees – Rotations – Insertion – Deletion -B-Trees: Definition of Btrees – Basic operations on B-Trees – Deleting a key from a B-Tree- Fibonacci Heaps: structure – Mergeable-heap operations- Decreasing a key and deleting a node-Bounding the maximum degree.

Unit 03: GRAPHS — **9 Hours**

Elementary Graph Algorithms: Representations of Graphs – Breadth-First Search – Depth-First Search – Topological Sort – Strongly Connected Components- Minimum Spanning Trees: Growing a Minimum Spanning Tree – Kruskal and Prim- Single-Source Shortest Paths: The Bellman-Ford algorithm – Single-Source Shortest paths in Directed Acyclic Graphs – Dijkstra's Algorithm; All-Pairs Shortest Paths: Shortest

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Paths and Matrix Multiplication – The FloydWarshall Algorithm.	
Unit 04: ALGORITHM DESIGN TECHNIQUES	**9 Hours**
Dynamic Programming: Matrix-Chain Multiplication – Elements of Dynamic Programming – Longest Common Subsequence- Greedy Algorithms: An Activity-Selection Problem – Elements of the Greedy Strategy- Huffman Codes.	
Unit 05: NP COMPLETE AND NP HARD	**9 Hours**
NP-Completeness: Polynomial Time – Polynomial-Time Verification – NP- Completeness and Reducability – NP-Completeness Proofs – NP-Complete Problems	

Theory: 45 Hrs	Tutorial: 0	Practical: 0	Project: 0	Total Hours: 45 Hrs

REFERENCES

1.	Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, Data Structures and Algorithms, Pearson Education, Reprint 2006.
2.	S.Sridhar,Design and Analysis of Algorithmsl, First Edition, Oxford University Press, 2014.
3.	Robert Sedgewick and Kevin Wayne, —ALGORITHMS, Fourth Edition, Pearson Education, 2011.
4.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, —Introduction to Algorithmsl, Third Edition, Prentice-Hall, 2011.
5.	Anany Levitin, Introduction to the Design and Analysis of Algorithms, Pearson Education, Third Edtion 2017.
6.	Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Fundamentals of Data Structures in C, Universities Press; Second edition, 2008.

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P23CSE102	ADVANCED COMPUTER ARCHITECTURE	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

At the end of the course, the student will be able to

CO1:	Discuss the issues related to multiprocessing and suggest solutions
CO2:	Discuss the salient features of different multicore architectures and how they exploit parallelism.
CO3:	Discuss the various techniques used for optimising the cache performance
CO4:	Design hierarchal memory system
CO5:	Analyze how data level parallelism is exploited in architectures

Pre-requisite:

CO/PO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	1	3	1	1	2
CO2	1	1	2	2	1
CO3	1	3	2	3	2
CO4	1	2	2	3	2
CO5	1	2	2	3	2

Course Assessment methods

Direct		Indirect
CIE test I (10) CIE test II (10) CIE test III (10)	Assignment / Problem-solving / Seminar (10) Total CIE: 40 marks Semester End Examination: 60 marks	Course end survey

Unit 01: FUNDAMENTALS OF COMPUTER DESIGN AND ILP — **9 Hours**

Fundamentals of Computer Design – Measuring and Reporting Performance – Instruction Level Parallelism and its Exploitation – Concepts and Challenges –Exposing ILP - Advanced Branch Prediction - Dynamic Scheduling - Hardware-Based Speculation - Exploiting ILP - Instruction Delivery and Speculation - Limitations of ILP – Multithreading

Unit 02: MEMORY HIERARCHY DESIGN — **9 Hours**

Introduction – Optimizations of Cache Performance – Memory Technology and Optimizations – Protection: Virtual Memory and Virtual Machines – Design of Memory Hierarchies – Case Studies.

Unit 03: MULTIPROCESSOR ISSUES — **9 Hours**

Introduction- Centralized, Symmetric and Distributed Shared Memory Architectures –Cache Coherence Issues – Performance Issues – Synchronization – Models of Memory Consistency – Case Study- Interconnection Networks – Buses, Crossbar and Multi-stage Interconnection Networks

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Unit 04: MULTICORE ARCHITECTURES	9 Hours
Homogeneous and Heterogeneous Multi-core Architectures – Intel Multicore Architectures – SUN CMP architecture – IBM Cell Architecture. Introduction to Warehouse-scale computersArchitectures- Physical Infrastructure and Costs- Cloud Computing –Case Study- Google Warehouse-Scale Computer	
Unit 05: VECTOR, SIMD AND GPU ARCHITECTURES	**9 Hours**
Introduction-Vector Architecture – SIMD Extensions for Multimedia – Graphics Processing Units – Case Studies – GPGPU Computing – Detecting and Enhancing Loop Level Parallelism-Case Studies	

Theory: 45 Hrs	Tutorial: 0	Practical: 0	Project: 0	Total Hours: 45 Hrs

REFERENCES

1.	Darryl Gove, "Multicore Application Programming: For Windows, Linux, and Oracle Solaris", Pearson, 2011
2.	David B. Kirk, Wen-mei W. Hwu, "Programming Massively Parallel Processors", Morgan Kauffman, 2010
3.	David E. Culler, Jaswinder Pal Singh, "Parallel computing architecture : A hardware/software approach" , Morgan Kaufmann /Elsevier Publishers, 1999
4.	John L. Hennessey and David A. Patterson, "Computer Architecture – A Quantitative Approach", Morgan Kaufmann / Elsevier, 5th edition, 2012.
5.	Kai Hwang and Zhi.Wei Xu, "Scalable Parallel Computing", Tata McGraw Hill, NewDelhi, 2003

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P23CSE103	ADVANCED OPERATING SYSTEMS	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

At the end of the course, the student will be able to

CO1:	Apply the operating system concepts to a distributed environment and identify the features specific to distributed systems.
CO2:	Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating systems.
CO3:	Discuss the different consistency model, replacement strategy in distributed shared memory.
CO4:	Apply the distributed system concepts for any scenario.
CO5:	Analyze the role of operating systems in cloud and mobile environment.

Pre-requisite:

CO/PO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	1	3	2	2	1
CO2	2	2	3	2	1
CO3	1	1	1	3	2
CO4	1	1	2	1	2
CO5	1	2	2	1	1

Course Assessment methods

Direct		Indirect
CIE test I (10) CIE test II (10) CIE test III (10)	Assignment / Problem-solving / Seminar (10) Total CIE: 40 marks Semester End Examination: 60 marks	Course end survey

Unit 01: INTRODUCTION **9 Hours**

Distributed Operating Systems – Issues – Communication Primitives – Limitations of a Distributed System – Lamport's Logical Clocks – Vector Clocks – Causal Ordering of Messages

Unit 02: DISTRIBUTED OPERATING SYSTEMS **9 Hours**

Distributed Mutual Exclusion Algorithms – Classification – Preliminaries – Simple Solution – Lamport's Algorithm – Ricart-Agrawala Algorithm – Suzuki-Kasami's Broadcast Algorithm –Raymond's Tree-Based Algorithm – Distributed Deadlock Detection – Preliminaries – Centralized Deadlock Detection Algorithms – Distributed Deadlock Detection Algorithms – Path Pushing Algorithm – Edge Chasing Algorithm – Hierarchical Deadlock Detection Algorithms – Agreement Protocols – Classification – Solutions to the Byzantine Agreement Problem – Lamport- Shostak Pease Algorithm

Unit 03: DISTRIBUTED RESOURCE MANAGEMENT **9 Hours**

Distributed File Systems – Design Issues – Google File System – Hadoop Distributed File System – Distributed Shared Memory – Algorithms for Implementing Distributed Shared Memory – Load Distributing

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Algorithms – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Nonblocking Commit Protocol	
Unit 04: REAL TIME OPERATING SYSTEMS	**9 Hours**
Basic Model of Real - Time Systems – Characteristics – Application of Real - Time Systems – Real - Time Task Scheduling— Handling Resource Sharing –Case Study –Minix OS	
Unit 05: MOBILE AND CLOUD OPERATING SYSTEM	**9 Hours**
Android – Overall Architecture – Linux Kernel – Hardware Support – Native User-Space – Dalvik and Android's Java –System Services – Introduction to Cloud Operating Systems.	

Theory: 45 Hrs	Tutorial: 0	Practical: 0	Project: 0	Total Hours: 45 Hrs

REFERENCES

1.	Mukesh Singhal, Niranjan G.Shivaratri, "Advanced concepts in operating systems: Distributed, Database and multiprocessor operating systems", TMH, 2001
2.	Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education India, 2006.
3.	Karim Yaghmour, "Embedded Android", O'Reilly, First Edition, 2013.
4.	Nikolay Elenkov, "Android Security Internals: An In-Depth Guide to Android's Security Architecture", No Starch Press,2014

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P23CSE104	ADVANCED DATA STRUCTURES AND ALGORITHMS LABORATORY	L	T	P	J	C
		0	0	2	2	2

Course Outcomes

At the end of the course, the student will be able to

CO1:	Design and implement basic and advanced data structures for real applications
CO2:	Design algorithms using graph structures
CO3:	Implement for real applications using design techniques

Pre-requisite:

CO/PO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	1	3	2	2	1
CO2	2	2	3	2	1
CO3	1	1	1	3	2

Course Assessment methods

Direct		Indirect
CIE test I (10)-Laboratory Quiz 1 (5) CIE test II (10)- Laboratory Quiz 1 (5)	CIE(10)-Project Record(10) Total CIE: 50 marks Semester End Examination (50) SEE :Laboratory	Course end survey

List of Experiments:

1. Implementation of Merge Sort and Quick Sort-Algorithms
2. Implementation of a Binary Search Tree
3. Red-Black Tree Implementation
4. Heap Implementation
5. Fibonacci Heap Implementation
6. Graph Traversals
7. Spanning Tree Implementation
8. Shortest Path Algorithms (Dijkstra's algorithm, Bellmann Ford Algorithm)
9. Implementation of Matrix Chain Multiplication
10. Activity Selection and Huffman Coding Implementation.

Design and develop application with suitable data structures for the use cases

- Snakes Game (Arrays)
- Sudoku (Backtracking)
- Travel Planner (Graphs)
- Cash Flow Minimiser (Graphs/Multisets/Heaps)
- Text Editor Cut, Copy, Paste (Stack)
- File Zipper (Greedy Huffman Encoder)
- CB Mario (Dynamic Programming Optimisation in Game)
- Jump Froggy (Greedy Optimisation in Game)

Theory: 0	Tutorial: 0	Practical: 30	Project: 30	Total Hours: 60 Hrs

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P23CSE105	ADVANCED OPERATING SYSTEMS LABORATORY	L	T	P	J	C
		0	0	2	2	2

Course Outcomes

At the end of the course, the student will be able to

CO1:	Design and implement basic distributed operating systems concepts
CO2:	Design algorithms using shared memory
CO3:	Develop capabilities to work at systems level

Pre-requisite:

CO/PO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	1	3	2	2	1
CO2	2	2	3	2	1
CO3	1	1	1	3	2

Course Assessment methods

Direct		Indirect
CIE test I (10)-Laboratory Quiz 1 (5) CIE test II (10)- Laboratory Quiz 1 (5)	CIE(10)-Project Record(10) Total CIE: 50 marks Semester End Examination (50) SEE :Laboratory	Course end survey

List of Experiments:

1. Implementation of non token based algorithm for Mutual Exclusion
2. Implementation of Lamport's Logical Clock
3. Implementation of edge chasing distributed deadlock detection algorithm.
4. Implementation of locking algorithm
5. Incrementing a counter in shared memory.
6. Implementation of Remote Method Invocation.
7. Implementation of Remote Procedure Call.
8. Implementation of Chat Server

Case Studies

1. Development of a reasonably sized dynamically loadable kernel module for Linux kernel
2. Study educational operating systems such as Minix (http://www.minix3.org/), Weenix (http://weenix.cs.brown.edu/mediawiki/index.php/Weenix) and develop reasonably sized interesting modules for them
3. Study the Android open source operating system for mobile devices (http://source.android.com/) and develop / modify some modules.
4. Study any embedded and real-time operating system such as eCos (http://ecos.sourceware.org/) and develop / modify some modules.

Theory: 0	Tutorial: 0	Practical: 30	Project: 30	Total Hours: 60 Hrs

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P23GE101 **RESEARCH METHODOLOGY AND IPR** 3 0 0 0 3

(Common to all M.E /M.Tech Programmes)

COURSE OUTCOMES:

At the end of the course, the student will be able to

1. Review the literature of the research problem
2. Choose appropriate data collection and sampling method according to the research problem.
3. Interpret the results of research and communicate effectively with their peers
4. Explain the Importance of intellectual property rights
5. Evaluate trade mark, develop and register patents.

CO/PO, PSO Mapping (3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak COs Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)					
COs	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	3	3
CO2	2	3	3	3	3
CO3	2	3	3	3	3
CO4	2	3	3	3	3
CO5	3	3	3	3	3

Course Assessment methods

Direct		Indirect
CIE test I (10) (Theory) CIE test II (10) (Theory) CIE test III (10) (Theory)	Assignment / Problem –Solving /Seminar (10) Total CIE: **40 Marks** Semester End Examination : **60 Marks**	Course end survey

UNIT I INTRODUCTION TO RESEARCH METHODS 9

Definition and Objective of Research, Various steps in Scientific Research, Types of Research, Criteria for Good Research, Defining Research Problem, Research Design , Case Study Collection of Primary and Secondary Data, Collection Methods: Observation, Interview, Questionnaires, Schedules,

UNIT II SAMPLING DESIGN AND HYPOTHESIS TESTING 9

steps in Sampling Design, Types of Sample Designs, Measurements and Scaling Techniques -Testing of hypotheses concerning means (one mean and difference between two means -one tailed and two tailed tests), concerning variance — one tailed Chi-square test.

UNIT II INTERPRETATION AND REPORT WRITING 9

Techniques of Interpretation, Precaution in Interpretation, Layout of Research Report, Types of Reports, Oral Presentation, Mechanics of Writing Research Report

UNIT IV INTRODUCTION TO INTELLECTUAL PROPERTY 9

Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights, Innovations and Inventions trade related intellectual property rights.

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UNIT V TRADE MARKS, COPY RIGHTS AND PATENTS 9

Purpose and function of trade marks, acquisition of trade mark rights, trade mark registration processes, trademark claims —trademark Litigations- International trademark law Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

Lecture: 45, Tutorial: 0, Total: 45 Hours

TEXT BOOKS

1. C.R. Kothari, Gaurav Garg, Research Methodology Methods and Techniques An Edition, New Age International Publishers, 2019.
2. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets", Delmar Cengage Learning, 4" Edition, 2012.
3. Prabuddha Ganguli, "Intellectual Property Rights: Unleashing the Knowledge Economy", Tata Mc Graw Hill Education, 1" Edition, 2008.

REFERENCE BOOKS

1. Panneerselvam, R., Research Methodology, Second Edition, Prentice-Hall of India, New Delhi, 2013.
2. Ranjith Kumar, Research Methodology — A step by step Guide for Begineers, 4" edition, Sage publisher, 2014.
3. D Llewelyn & T Aplin W Cornish, "Intellectual Property: Patents, Copyright, Trade Marks and Allied Rights", Sweet and Maxwell, 1" Edition, 2016.
4. Ananth Padmanabhan, "Intellectual Property Rights-Infringement and Remedies", Lexis Nexis, 1" Edition, 2012.
5. Ramakrishna B and Anil Kumar H.S, "Fundamentals of Intellectual Property Rights: For Students, Industrialist and Patent Lawyers", Notion Press, 1" Edition, 2017.
6. M.Ashok Kumar and Mohd. Iqbal Ali :"Intellectual Property Rights" Serials Pub

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P23GE702	Stress Management by Yoga	L	T	P	J	C
		2	0	0	0	0

Course Outcomes

At the end of the course, the student will be able to

CO1:	Develop physical and mental health thus improving social health
CO2:	Increase immunity power of the body and prevent diseases
CO3:	Accelerate memory power
CO4:	Achieve the set goal with confidence and determination
CO5:	Improve stability of mind, pleasing personality and work with awakened wisdom

Course Assessment methods

Direct		Indirect
CIE test I (30) CIE test II (30) CIE test III (40)	Total CIE: 100 marks Semester End Examination: NIL	Course end survey

Unit 01: **6 Hours**

Yoga-Introduction - Astanga Yoga- 8 parts-Yam and Niyam etc.- Do's and Don'ts in life-Benefits of Yoga and Asana- Yoga Exercise- and benefits- Pranayam Yoga- Nadi suthi, Practice and Spinal Sclearance Practice-Regularization of breathing techniques and its effects-Practice and kapalapathy practice.

Unit 02: **6 Hours**

Neuromuscular breathing exercise and Practice- Magarasa Yoga, 14 points Acupressure techniques and practice-Body relaxation practice and its benefits- Raja Yoga- 1.Agna –explanation and practice- Activation of Pituitary- Raja Yoga- 2. Santhi Yoga-Practice-Balancing of physical and mental power.

Unit 03: **6 Hours**

Raja Yoga- 3. Sagasrathara yoga –practice- Activation of dormant brain cells-Kayakalpa-theory- Kayakalpa –practice-Yogic exercise to improve physical and mental health and practice-Asanas –explanation-Practice-benefits

Unit 04: **6 Hours**

Sun namaskar- 12 poses-explanation and practice-Yoga –Asana-Padmasana, vajrasana,chakrasana, viruchasana etc-Stress management with Yoga-Role of women and Yoga Equality, nonviolence, Humanity, Self- control- Food and yoga Aware of self-destructive habits Avoid fault thinking (thought analysis-Practice)-Yoga Free from ANGER (Neutralization of anger)& practice

Unit 05: **6 Hours**

Moralisation of Desire & practice- Punctuality-Love-Kindness-Compassion Eradication of worries-Practice - Personality development, positive thinking-Good characters to lead a moral life How to clear the polluted mind- Benefits of blessing- Five- fold culture –explanation- Karma Yoga Practice In Geetha- Sense of duty-Devotion, self- reliance, confidence, concentration, truthfulness, cleanliness.

Theory: 30 Hrs	Tutorial: --	Practical: --	Project:--	Total Hours: 30 Hrs

REFERENCES

1	'Yogic Asanas for Group Tarining-Part-I" Janardan Swami Yogabhyasi Mandal, Nagpur
2	"Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

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Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for M.E/M.Tech. Semester II under Regulations 2023 (CBCS)
Branch: Computer Science and Engineering

S.No	Course Code	Course Title	L	T	P	J	C	Category	Total Contact Hours	Course Type*
Theory courses										
1.	P23CSE201	Advanced Databases	3	0	0	0	3	PC	45	T
2.	P23CSE202	Advanced Network Design	3	0	0	0	3	PC	45	T
3.	P23CSE522	**Elective:** Software Testing and Quality Assurance	3	0	0	0	3	PE	45	T
4.	P23CSE525	**Elective:** Foundations of Data Science	3	0	0	0	3	PE	45	T
5.	P23CSE535	**Elective:** Healthcare Data Analytics	3	0	0	0	3	PE	45	T
6.	P23GE701	**Audit Course:** English for Research Paper Writing	2	0	0	0	0	AC	30	T
Practical courses										
7.	P23CSE203	Advanced Databases Laboratory	0	0	2	2	2	PC	60	LP
8.	P23CSE204	Advanced Network Design Laboratory	0	0	2	2	2	PC	60	LP
							Total Credits		19	

*T- Theory, TT- Theory with Tutorial, TL- Theory with Laboratory, TP- Theory with Project, TLP- Theory with Laboratory and Project, L-Laboratory, LT- Laboratory with Theory, LP- Laboratory with Project

Approved By

Chairperson, Computer Science and Engineering BoS	Member Secretary, Academic Council	Dean-Academics	Chairperson, Academic Council & Principal
Dr.B.Sathiyabhama	Dr.R.Shivakumar	Dr.J.Akilandeswari	Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/ Computer Science and Engineering, Second Semester M.E CSE Students and Staff, COE

P23CSE201	ADVANCED DATABASES	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

At the end of the course, the student will be able to

CO1:	Comprehend the various database revolution
CO2:	Work with NoSQL databases to analyze the big data for useful business Applications.
CO3:	Analyze the different data models based on data representation methods and storage needs
CO4:	Design and develop using application programming interface with SQL and NoSQL databases
CO5:	Discover the survey on future generation databases

CO/PO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

Cos	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	3	2
CO2	2	1	3	2	2
CO3	3	1	3	3	2
CO4	3	1	3	2	2
CO5	3	1	3	3	3

Course Assessment methods

Direct		Indirect
CIE test I (10) CIE test II (10) CIE test III (10)	Assignment / Problem-solving / Seminar (10) Total CIE: 40 marks Semester End Examination: 60 marks	Course end survey

Unit 01: INTRODUCTION — **9 Hours**

Database Revolutions- System Architecture- Relational Database- Database Design Data Storage- Transaction Management- Data warehouse and Data Mining- Information Retrieval

Unit 02: Document Databases — **9 Hours**

Big Data Revolution- CAP Theorem- Birth of NoSQL- Document Database—XML Databases- JSON Document Databases- Graph Databases. Column Databases— Data Warehousing Schemes- Columnar Alternative- Sybase IQ- C-store and Vertica- Column Database Architectures- SSD and In-Memory Databases— In Memory Databases- Berkeley Analytics Data Stack and Spark

Unit 03: Distributed Database Patterns — **9 Hours**

Distributed Relational Databases- Non-relational Distributed Databases- MongoDB - Sharing and Replication- HBase- Cassandra Consistency Models— Types of Consistency- Consistency MongoDB- HBase Consistency- Cassandra Consistency.

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Unit 04: Data Models and Storage				9 Hours
SQL- NoSQL APIs- Return SQL- Advance Databases-PostgreSQL- Riak-HBase-MongoDB-Cassandra Query Language-MapReduce-Pig-DAG-Cascading-Spark- CouchDB- NEO4J- Redis				
Unit 05: Future Database				**9 Hours**
Database of Future-Key value database-Distrubutive transaction-Other Convergent Databases- Disruptive Database Technologies-Storage Technologies-BlockChain-Quantum Computing.				
Theory: 45 Hrs	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total Hours: 45 Hrs**

REFERENCES

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", Sixth Edition, Mc Graw Hill Education,2013
2. Guy Harrison, "Next Generation Databases", Apress, 2015
3. Eric Redmond, Jim R Wilson, "Seven Databases in Seven Weeks", LLC. 2012
4. Dan Sullivan, "NoSQL for Mere Mortals", Addison-Wesley, 2015
5. Adam Fowler, "NoSQL for Dummies ", John Wiley & Sons, 2015

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P23CSE202	ADVANCED NETWORK DESIGN	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

At the end of the course, the student will be able to

CO1:	Describe the fundamental concepts of computer networks
CO2:	Analyze the QoS properties in BE and GS models
CO3:	Describe the basic working principles of LTE networks
CO4:	Analyze the performance of SDN
CO5:	Analyze the performance of NGN

CO/PO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

Cos	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	2	-	2	3	2
CO2	3	-	3	2	2
CO3	3	1	2	3	3
CO4	2	1	3	2	3
CO5	3	1	3	3	3

Course Assessment methods

Direct		Indirect
CIE test I (10) CIE test II (10) CIE test III (10)	Assignment / Problem-solving / Seminar (10) Total CIE: 40 marks Semester End Examination: 60 marks	Course end survey

Unit 01: INTRODUCTION TO COMPUTER NETWORKING — **9 Hours**

Communication Networks –Network Elements –Switched Networks and Shared media Networks – Probabilistic Model and Deterministic Model –Datagrams and Virtual Circuits –Multiplexing–Switching - Error and Flow Control –Congestion Control –Layered Architecture –Network Externalities –Service Integration.

Unit 02: QUALITY OF SERVICE — **9 Hours**

Traffic Characteristics and Descriptors –Quality of Service and Metrics –Best Effort model and guaranteed Service Model –Limitations of IP networks –Scheduling and Dropping Policies for BE and GS models – Traffic Shaping Algorithms–End to End Solutions –Laissez Faire Approach –Possible improvements in TCP –Significance of UDP in Inelastic Traffic

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Unit 03: SOFTWARE DEFINED NETWORKING	9 Hours
Evolution of SDN -Control Plane - Control and data plane separation - Network Virtualization - Data Plane - Programming SDNs - Verification and Debugging - Openflow networks.	

Unit 04: INTERNET OF THINGS	9 Hours
Introduction - Definition and Characteristics of IoT - Physical design - IoT Protocols - Logical design - IoT communication models-IoT Communication APIs - Enabling technologies - Wireless Sensor Networks-Cloud Computing-Big data analytics, Communication protocols-Embedded Systems. IoT Levels and Templates - Domain specific IoTs - IoT Architectural view.IoT systems management – Needs – NETCONF-YANG - IoT design methodology-Case studies	

Unit 05: NEXT GENERATION NETWORKS	9 Hours
Next Generation Wireless Networks: GSM Evolution - WiMAX Networks - Long Term Evolution (LTE) - 5G architecture: Basics about RAN architecture, High-level requirements for the 5G architecture - Integration of LTE and new air interface to fulfill 5G Requirements - Physical architecture and 5G deployment.	

Theory: 45 Hrs	Tutorial: 0	Practical: 0	Project: 0	Total Hours: 45 Hrs

REFERENCES

1.	James Macfarlane," Network Routing Basics: Understanding IP Routing in Cisco Systems", Wiley edition 1 2006
2.	Jean Warland and Pravin Vareya, „High Performance Networks", Morgan Kauffman Publishers, 2002
3.	Larry L Peterson and Bruce S Davie, „Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufman Publishers, 2012
4.	Jingming Li Salina, Pascal Salina "Next Generation Networks-perspectives and potentials" Wiley, January 2008.
5.	Madhusanga Liyanage, Andrei Gurtov, Mika Ylianttila, "Software Defined Mobile Networks beyond LTE Network Architecture", Wiley, June 2015
6.	Thomas Nadeau, Ken Gray, "SDN - Software Defined Networks", O'reilly Publishers, 2013.
7.	Savo G Glisic," Advanced Wireless Networks- Technology and Business models", Wiley, 3rd edition- 2016.
8.	Thomas Plavyk, —Next generation Telecommunication Networks, Services and Managementl, Wiley & IEEE Press Publications, 2010.
9.	Afif Osseiran, Jose F. Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology", 1st edition, Cambridge University Press, 2016
10	Arshdeep Bahga, Vijay Madisetti, "Internet of Things-A hands-on approach", Universities Press, 2015.
11	Surya Durbha and Jyoti Joglekar, "Internet of Things", Oxford University Press, 2021

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P23CSE522	SOFTWARE TESTING AND QUALITY ASSURANCE	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

At the end of the course, the student will be able to

CO1:	Develop Quality plans and use SQA components in project life cycle.
CO2:	Analyze the product Quality.
CO3:	Judge the use of infrastructure components and use configuration items for Quality control.
CO4:	Use various testing methods and verify.
CO5:	Assess Quality standards of various software products

CO/PO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	3	-	3	1	1
CO2	3	-	3	2	1
CO3	3	-	3	2	1
CO4	3	1	3	2	1
CO5	3	1	3	2	1

Course Assessment methods

Direct		Indirect
CIE test I (10) CIE test II (10) CIE test III (10)	Assignment / Problem-solving / Seminar (10) Total CIE: 40 marks Semester End Examination: 60 marks	Course end survey

UNIT 01 INTRODUCTION — **9 Hours**

Introduction to Software Quality - Challenges – Quality Factors – Testing Activities – Test Case Selection – Power of Test – Components of SQA – SQA Components in Project Life Cycle – TestGroups – Software Quality Assurance Group – Reviews

UNIT 02 TESTING METHODOLOGIES — **9 Hours**

Basics of Software Testing – Test Generation from Requirements – Finite State Models – Combinatorial Designs - Test Selection, Minimization and Prioritization for Regression Testing – Test Adequacy, Assessment and Enhancement

UNIT 03 TEST STRATEGIES — **9 Hours**

Testing Strategies – White Box and Black Box Approach – Integration Testing – System and Acceptance Testing – Performance Testing – Regression Testing - Internationalization Testing – Ad-hoc Testing – Website Testing – Usability Testing – Accessibility Testing.

Unit 04: TEST AUTOMATION AND MANAGEMENT	9 Hours
Test plan – Management – Execution and Reporting – Software Test Automation – Automated Testing tools - Hierarchical Models of Software Quality – Configuration Management – Documentation Control.	
Unit 05: SOFTWARE QUALITY ASSURANCE	**9 Hours**
Project progress control – costs – quality management standards – project process standards – management and its role in SQA – SQA unit.	

Theory: 45 Hrs	Tutorial: 0	Practical: 0	Project: 0	Total Hours: 45 Hrs

REFERENCES

1.	Yogesh Singh, "Software Testing", Cambridge University Press, 2012
2.	Daniel Galin, "Software Quality Assurance – from Theory to Implementation" Pearson Education, 2009
3.	Aditya Mathur, "Foundations of Software Testing", Pearson Education, 2008
4.	Srinivasan Desikan, Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Education, 2006
5.	Ron Patton, "Software Testing" , Second Edition, Pearson Education, 2007

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P23CSE525	FOUNDATIONS OF DATA SCIENCE	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

At the end of the course, the student will be able to

CO1:	Define the data science process.
CO2:	Understand different types of data description for data science process
CO3:	Gain knowledge on relationships between data
CO4:	Use the python libraries for data wrangling
CO5:	Apply visualization libraries in python to interpret and explore data

CO/PO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

Cos	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	3	2
CO2	3	1	3	2	2
CO3	3	1	3	3	2
CO4	3	1	3	2	2
CO5	3	1	3	3	3

Course Assessment methods

Direct		Indirect
CIE test I (10) CIE test II (10) CIE test III (10)	Assignment / Problem-solving / Seminar (10) Total CIE: 40 marks Semester End Examination: 60 marks	Course end survey

Unit 01: INTRODUCTION — **9 Hours**

Data Science: Benefits and uses – facets of data – Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation – Exploratory Data analysis – build the model– presenting findings and building applications – Data Mining – Data Warehousing – Basic Statistical descriptions of Data

Unit 02: DESCRIBING DATA — **9 Hours**

Types of Data – Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages – Describing Variability – Normal Distributions and Standard (z) Scores

Unit 03: DESCRIBING RELATIONSHIPS — **9 Hours**

Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of

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estimate – interpretation of r2 –multiple regression equations –regression towards the mean	
Unit 04: PYTHON LIBRARIES FOR DATA WRANGLING	**9 Hours**
Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables	
Unit 05: DATA VISUALIZATION	**9 Hours**
Foundation for a Science of Data Visualization – Environment- Optics –Optimal Display – Overviewabout Lightness, Brightness, Contrast, Constancy, Color –Visual attention that Pops Out - Importing Matplotlib – Line plots – Scatter plots – three dimensional plotting – Geographic Data with Basemap – Visualization with Seaborn.	

Theory: 45 Hrs	Tutorial: 0	Practical: 0	Project: 0	Total Hours: 45 Hrs

REFERENCES

1.	David Cielen, Arno D. B, Meysman and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.
2.	Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.
3.	Jake Vander Plas, "Python Data Science Handbook", O'Reilly, 2016.
4.	Matthew O. Ward, George Grinstein, Daniel Keim, "Interactive Data Visualization: Foundation, Techniques and Applications", Second Edition, A. K. Peters/CRC Press, 2015

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P23CSE535	HEALTHCARE DATA ANALYTICS	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

At the end of the course, the student will be able to

CO1:	Select appropriate analytical techniques to analyze health care data using
CO2:	Apply analytics for decision making in medical images processing and social media healthcare data
CO3:	Predict the risk analytics for healthcare domain
CO4:	Analyze the various predictions models used in Clinical data processing
CO5:	Apply data mining and analytics techniques to integrate health data from multiple sources and develop efficient clinical decision support systems

CO/PO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

Cos	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	3	2
CO2	3	1	3	2	2
CO3	3	1	3	3	2
CO4	3	1	3	2	2
CO5	3	1	3	3	3

Course Assessment methods

Direct		Indirect
CIE test I (10) CIE test II (10) CIE test III (10)	Assignment / Problem-solving / Seminar (10) Total CIE: 40 marks Semester End Examination: 60 marks	Course end survey

Unit 01: INTRODUCTION — **9 Hours**

Introduction to Healthcare Data Analytics- Electronic Health Records - Components of EHR- Coding Systems- Benefits of EHR- Barrier to Adopting EHR- Challenges- Phenotyping Algorithms

Unit 02: ANALYSIS — **9 Hours**

Biomedical Image Analysis- Mining Of Sensor Data In Healthcare - Biomedical Signal Analysis - Genomic Data Analysis For Personalized Medicine. Analytics: Natural Language Processing And Data Mining For Clinical Text- Mining The Biomedical - Social Media Analytics For Healthcare.

Unit 03: RISK ANALYTICS FOR HEALTHCARE DOMAIN — **9 Hours**

Introduction to Healthcare Sector; HIPAA, Four Enterprise Disciplines of Health Analytics, Health Outcome Analysis, Health Value and Cost; Customer Insights, Actuary Services, Framework for Customer Analytics;

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Risk Management.				
Unit 04: ADVANCED DATA ANALYTICS				**9 Hours**
Advanced Data Analytics for Healthcare - Review of Clinical Prediction Models - Temporal Data Mining for Healthcare Data- Visual Analytics for Healthcare- Predictive Models for Integrating Clinical and Genomic Data - Information Retrieval for Healthcare - Privacy-Preserving Data Publishing Methods in Healthcare.				
Unit 05: APPLICATIONS				**9 Hours**
Applications and Practical Systems for Healthcare - Data Analytics for Pervasive Health- Fraud Detection in Healthcare - Data Analytics for Pharmaceutical Discoveries - Clinical Decision Support Systems - Computer-Assisted Medical Image Analysis Systems - Mobile Imaging and Analytics for Biomedical Data.				
Theory: 45 Hrs	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total Hours: 45 Hrs**

REFERENCES

1.	Chandan K. Reddy and Charu C Aggarwal, "Healthcare data analytics", Chapman and Hall/CRC; 1st edition, 2015.
2.	Hui Yang and Eva K. Lee, "Healthcare Analytics: From Data to Knowledge to Healthcare Improvement, Wiley-Blackwell, 1st edition, 2016.
3.	Laura B. Madsen, "Data-Driven Healthcare: How Analytics and BI are Transforming the Industry (WILEY Big Data Series)", Wiley, 2015.
4.	Jason Burke, "Health Analytics: Gaining the Insights to Transform Healthcare", John Wiley & Sons Inc., 2013, ISBN: 978-1-118-38304-9.
5.	Trevor L. Strome, "Healthcare Analytics for Quality and Performance Improvement", John Wiley & Sons, 1st edition, 2013.

P23CSE203	ADVANCED DATABASES LABORATORY	L	T	P	J	C
		0	0	2	2	2

Course Outcomes

At the end of the course, the student will be able to

CO1:	Create and work on distributed, object oriented and parallel databases
CO2:	Experiment on active and deductive database
CO3:	Design the database using XML for real time application

CO/PO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

Cos	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	3	2
CO2	3	2	3	2	2
CO3	3	1	3	3	2
CO4	3	3	3	2	2
CO5	3	3	3	3	3

Course Assessment methods

Direct		Indirect
CIE test I (10) -Laboratory Quiz 1 (5) CIE test II (10) -Laboratory Quiz 2 (5)	CIE test III (10) -Project Record (10) Total CIE: 50 marks Semester End Examination: 50 marks SEE :Laboratory	Course end survey

List of Experiments:

1. Distributed Database design for real time application
2. Deadlock Detection Algorithm for distributed database using wait- for graph
3. Experiment using Object Oriented Database – Extended Entity Relationship (EER)
4. Design Parallel Database for real time application
5. Parallel Database – Implementation of Parallel Join and Parallel Sort
6. Active Database – Implementation of Triggers & Assertions for Bank Database
7. Model building and interpretation of results using WEKA tool
8. Implementation of an Efficient Query Optimization
9. Designing XML Schema for a given database
10. Integrate Node.js with SQL Database (MySQL/PostgreSQL/Oracle)
11. Integrate Node.js with No SQL Database (MongoDB/Cassandra)

Theory: 0	Tutorial: 0	Practical: 30	Project: 30	Total Hours: 60 Hrs

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P23CSE204	ADVANCED NETWORK DESIGN LABORATORY	L	T	P	J	C
		0	0	2	2	2

Course Outcomes

At the end of the course, the student will be able to

CO1:	Design and develop TCP/UDP client – server applications using java
CO2:	Develop client – server applications using Python
CO3:	Simulate network applications using ns2

CO/PO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

Cos	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	3	2
CO2	2	2	3	2	2
CO3	3	3	3	3	2
CO4	3	3	3	2	2
CO5	3	3	3	3	3

Course Assessment methods

Direct		Indirect
CIE test I (10) -Laboratory Quiz 1 (5) CIE test II (10) -Laboratory Quiz 2 (5)	CIE test III (10) -Project Record (10) Total CIE: 50 marks Semester End Examination: 50 marks SEE :Laboratory	Course end survey

List of Experiments:

1. Design a TCP client/server application
2. Design a UDP client/server application
3. Design an Iterative UDP server with 2 or 3 clients
4. Build client applications for major APIs (Amazon S3, Twitter etc) in Python
5. Design an application that interacts with e-mail servers in python
6. Design applications that work with remote servers using SSH, FTP etc in Python
7. Create a LAN Network and compare the performance between MAC protocols using ns-2
8. Simulate DVR and LSR routing using ns-2
9. Create a wireless network environment with mobile nodes and transfer the data using AODV using ns-2
10. Projects using CISCO packet tracer

Theory: 0 Hrs	Tutorial: 0	Practical: 30	Project:30	Total Hours: 60 Hrs

P23GE701	English for Research Paper Writing	L	T	P	J	C
		2	0	0	0	0

Course Outcomes

At the end of the course, the student will be able to

CO1:	Demonstrate research writing skills both for research articles and thesis
CO2:	Frame suitable title and captions as sub-headings for articles and thesis
CO3:	Write each section in a research paper and thesis coherently
CO4:	Use language appropriately and proficiently for effective written communication
CO5:	Exhibit professional proof-reading skills to make the writing error free

Course Assessment methods

Direct		Indirect
CIE test I (30) CIE test II (30) CIE test III (40)	Total CIE: 100 marks Semester End Examination: NIL	Course end survey

Unit 01:	**6 Hours**
Planning and preparation, word order, breaking up long sentences, organising ideas into paragraphs and sentences, being concise and avoiding redundancy, ambiguity and vagueness	
Unit 02:	**6 Hours**
Interpreting research findings, understanding and avoiding plagiarism, paraphrasing sections of a paper/ abstract.	
Unit 03:	**6 Hours**
Key skills to frame a title, to draft an abstract, to give an introduction	
Unit 04:	**6 Hours**
Skills required to organise review of literature, methods, results, discussion and conclusions	
Unit 05:	**6 Hours**
Usage of appropriate phrases and key terms to make the writing effective - proof-reading to ensure error-free writing	

Theory: 30 Hrs	Tutorial: --	Practical: --	Project:--	Total Hours: 30 Hrs

TEXT BOOKS

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Highman N , Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book, 1998
3. Day R, How to Write and Publish a Scientific Paper, Cambridge University Press, 2006.
4. Goldbort R, Writing for Science, Yale University Press, 2006. (available on Google Books)

REFERENCES

1. Martin Cutts, Oxford Guide to Plain English, Oxford University Press, Second Edition, 2006

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Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for M.E/M.Tech. Semester III under Regulations 2023 (CBCS)
Branch: Computer Science and Engineering

S.No	Course Code	Course Title	L	T	P	J	C	Category	Total Contact Hours	Course Type*
Theory courses										
1.	P23CSE512	**Elective:** Information Retrieval	3	0	0	0	3	PE	45	T
2.	P23CSE518	**Elective:** Software Security	3	0	0	0	3	PE	45	T
3.	P23CSE524	**Elective:** Visualization Techniques	3	0	0	0	3	PE	45	T
Practical courses										
4.	P23CSE301	Project Work -I	0	0	0	16	08	PC	240	P
						Total Credits	**17**			

*T- Theory, TT- Theory with Tutorial, TL- Theory with Laboratory, TP- Theory with Project, TLP- Theory with Laboratory and Project, L-Laboratory, LT- Laboratory with Theory, LP- Laboratory with Project, P- Project.

Approved By

Chairperson -- CSE BoS	**Member Secretary/ Academic Council**	**Dean-Academics**	**Chairperson, Academic Council & Principal**
Dr.B.Sathiyabhama	**Dr.R.Shivakumar**	**Dr.J.Akilandeswari**	**Dr.S.R.R.Senthil Kumar**

Copy to:-
HOD/ CSE, Third Semester ME CSE Students and Staff, COE

P23CSE512	INFORMATION RETRIEVAL	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

At the end of the course, the student will be able to

CO1:	Build an Information Retrieval system using the available tools.
CO2:	Identify and design the various components of an Information Retrieval system.
CO3:	Measure effectiveness and efficiency of information retrieval techniques.
CO4:	Use parallel Information Retrieval approaches in real world problems.
CO5:	Design an efficient search engine and analyze the Web content structure

CO/PO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

Cos	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	2	-	2	3	2
CO2	3	-	3	2	2
CO3	3	1	2	3	3
CO4	2	1	3	2	3
CO5	3	1	3	3	3

Course Assessment methods

Direct		Indirect
CIE test I (10) CIE test II (10) CIE test III (10)	Assignment / Problem-solving / Seminar (10) Total CIE: 40 marks Semester End Examination: 60 marks	Course end survey

Unit 01: INTRODUCTION — **9 Hours**

Basic Concepts – Practical Issues – Retrieval Process – Architecture – Boolean Retrieval Retrieval Evaluation – Open Source IR Systems–History of Web Search – Web Characteristics– The impact of the web on IR –IR Versus Web Search–Components of a Search engine

Unit 02: RETRIEVAL MODELING — **9 Hours**

Taxonomy and Characterization of IR Models – Boolean Model – Vector Model – Term Weighting-Scoring and Ranking –Language Models – Set Theoretic Models – Probabilistic Models – Algebraic Models – Structured Text Retrieval Models – Models for Browsing

Unit 03: INDEXING — **9 Hours**

Static and Dynamic Inverted Indices – Index Construction and Index Compression. Searching – Sequential Searching and Pattern Matching. Query Operations –Query Languages – Query

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Processing – Relevance Feedback and Query Expansion – Automatic Local and Global Analysis – Measuring Effectiveness and Efficiency				
Unit 04: EVALUATION AND PARALLEL INFORMATION RETRIEVAL				**9 Hours**
Traditional Effectiveness Measures – Statistics in Evaluation – Minimizing Adjudication Effect – Nontraditional Effectiveness Measures – Measuring Efficiency – Efficiency Criteria–Queueing Theory – Query Scheduling – Parallel Information Retrieval – Parallel Query Processing – MapReduce				
Unit 05: SEARCHING THE WEB				**9 Hours**
Searching the Web –Structure of the Web –IR and web search – Static and Dynamic Ranking – Web Crawling and Indexing – Link Analysis – XML Retrieval Multimedia IR: Models and Languages – Indexing and Searching Parallel and Distributed IR – Digital Libraries				
Theory: 45 Hrs	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total Hours: 45 Hrs**

REFERENCES

1. Ricardo Baeza – Yates, Berthier Ribeiro – Neto, "Modern Information Retrieval: The Concepts and Technology behind Search", (ACM Press Books), Second Edition, 2011.
2. Chrstopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, "Introduction to Information Retrieval", Cambridge University Press, First South Asian Edition, 2008.
3. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, "Information Retrieval Implementing and Evaluating Search Engines", The MIT Press, Cambridge, Massachusetts London, England, 2010.

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P23CSE518	SOFTWARE SECURITY	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

At the end of the course, the student will be able to

CO1:	Comprehend various vulnerabilities related to memory attacks.
CO2:	Apply security principles in software development.
CO3:	Evaluate the extent of security risks
CO4:	Analyze selection of testing techniques related to software security in the testing phase ofsoftware development.
CO5:	Implement the tools for securing software

CO/PO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	3	-	3	1	1
CO2	3	-	3	2	1
CO3	3	-	3	2	1
CO4	3	1	3	2	1
CO5	3	1	3	2	1

Course Assessment methods

Direct		Indirect
CIE test I (10) CIE test II (10) CIE test III (10)	Assignment / Problem-solving / Seminar (10) Total CIE: 40 marks Semester End Examination: 60 marks	Course end survey

Unit 01: LOW-LEVEL ATTACKS — **9 Hours**

Need for Software Security – Memory-Based Attacks – Low-Level Attacks Against Heap And Stack-Stack Smashing – Buffer Overflow – Code Injection - Format String Attacks – ROP (Return Oriented Programming) – Defense against Memory-Based Attacks – Stack Canaries – Non-Executable Data - Address Space Layout Randomization (ASLR)- Memory-Safety Enforcement - Control-Flow Integrity (CFI) – Randomization

Unit 02: WEB SECURITY AND SECURE DESIGN — **9 Hours**

SQL Injection - Session Hijacking – Cross-Site Scripting (XSS), Cross-Site Forgery (CSRF) – Database Security – File Security - Secure Design - Threat Modeling and Security Design Principles - Good and Bad Software Design

Unit 03: SECURITY RISK MANAGEMENT — **9 Hours**

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Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management				
Unit 04: SECURITY TESTING				**9 Hours**
Traditional Software Testing – Comparison - Secure Software Development Life Cycle - Risk Based Security Testing – Prioritizing Security Testing with Threat Modeling – Shades of Analysis: White, Grey, and Black Box Testing				
Unit 05: PENETRATION TESTING				**9 Hours**
Advanced Penetration Testing – Planning And Scoping – DNS Groper – DIG (Domain Information Graph) – Enumeration – Remote Exploitation – Web Application Exploitation - Exploits And Client Side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection - Tools for Penetration Testing				
Theory: 45 Hrs	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total Hours: 45 Hrs**

REFERENCES

1. Robert C. Seacord, "Secure Coding in C and C++ (SEI Series in Software Engineering)", Addison-Wesley Professional, 2005.
2. Jon Erickson , "Hacking: The Art of Exploitation", 2nd Edition, No Starch Press, 2008.
3. Mike Shema, "Hacking Web Apps: Detecting and Preventing Web Application Security Problems", First edition, Syngress Publishing, 2012
4. Bryan Sullivan and Vincent Liu, "Web Application Security, A Beginner's Guide", Kindle Edition, McGraw Hill, 2012
5. Evan Wheeler, "Security Risk Management: Building an Information Security Risk Management Program from the Ground Up", First edition, Syngress Publishing, 2011
6. Chris Wysopal, Lucas Nelson, Dino Dai Zovi, and Elfriede Dustin, "The Art of Software Security Testing: Identifying Software Security Flaws (Symantec Press)", Addison-Wesley Professional,2006
7. Lee Allen, "Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)", Kindle Edition, Packt Publishing, 2012.

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P23CSE524	VISUALIZATION TECHNIQUES	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

At the end of the course, the student will be able to

CO1:	Apply mathematics and basic science knowledge for designing information visualizing System.
CO2:	Collect data ethically and solve engineering problem in visualizing the information.
CO3:	Implement algorithms and techniques for interactive information visualization.
CO4:	Conduct experiments by applying various modern visualization tool and solve the space layout problem.
CO5:	Analyze and design system to visualize multidisciplinary multivariate Data individually or in teams

CO/PO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

Cos	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	3	2
CO2	2	1	3	2	2
CO3	3	1	3	3	2
CO4	3	1	3	2	2
CO5	3	1	3	3	3

Course Assessment methods

Direct		Indirect
CIE test I (10) CIE test II (10) CIE test III (10)	Assignment / Problem-solving / Seminar (10) Total CIE: 40 marks Semester End Examination: 60 marks	Course end survey

Unit 01: INTRODUCTION — **9 Hours**

Introduction – Visualization Stages – Computational Support – Issues – Different Types of Tasks –Data representation – Limitation: Display Space, Rendering Time, Navigation Link.

Unit 02: DATA REPRESENTATION - I — **9 Hours**

Human Factors – Foundation for Science of Data Visualization – Environment- Optics – Optimal Display – Overview about Lightness, Brightness, Contrast, Constancy, Color –Visual attention that Pops Out – Types of Data – Data Complexity – The Encoding of Values –Encoding of Relation – Relation and Connection – Alternative Canvass

Unit 03: DATA REPRESENTATION - II — **9 Hours**

Human Vision – Space Limitation – Time Limitations – Design – Exploration of Complex InformationSpace – Figure Caption in Visual Interface – Visual Objects and Data Objects – Space Perception and Data in Space – Images, Narrative and Gestures for Explanation.

Unit 04: INTERACTION AND DESIGN	9 Hours
Norman's Action Cycle – Interacting with Visualization – Interaction for Information Visualization – Interaction for Navigation – Interaction with Models – Interacting with Visualization – Interactive 3D Illustrations with Images and Text– Personal View – Attitude – userperspective – Convergence – Sketching – Evaluation	
Unit 05: CURRENT TRENDS	**9 Hours**
Design – Virtual Reality: Interactive Medical Application – Tactile Maps for Visually Challenged People – Animation Design for Simulation – Integrating Spatial and Nonspatial Data – Innovating the Interaction-Small Interactive Calendars – Selecting One from Many – Web Browsing Through a Key Hole – Communication Analysis – Archival Galaxies.	

Theory: 45 Hrs	Tutorial: 0	Practical: 0	Project: 0	Total Hours: 45 Hrs

REFERENCES

1.	Robert Spence, "Information Visualization An Introduction", Third Edition, Pearson Education, 2014.
2.	Colin Ware, "Information Visualization Perception for Design", Third edition, Margon Kaufmann Publishers, 2012.
3.	Robert Spence, "Information Visualization Design for Interaction", Second Edition, Pearson Education, 2006.
4.	Benjamin B. Bederson and Ben shneiderman, "The Craft of Information Visualization", Morgan Kaufmann Publishers, 2003.
5.	Thomas strothotte, "Computational Visualization: Graphics, Abstraction and Interactivity", Springer, 1998.
6.	Matthew O. Ward, George Grinstein, Daniel Keim, "Interactive Data Visualization: Foundation, Techniques and Applications", Second Edition, A. K. Peters/CRC Press, 2015.
7.	Joerg Osarek, "Virtual Reality Analytics", Gordon's Arcade, 2016.

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P23CSE301	PROJECT WORK -I	L	T	P	J	C
		0	0	0	16	8

Course Outcomes

At the end of the course, the student will be able to

CO1:	Identify the research problems addressing emerging challenges and opportunities in the computer science engineering field
CO2:	Design and develop innovative solution to solve the research problem identified with latest technology and tools
CO3:	Apply analytical methods to assess and improve project outcomes and processes

CO/PO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

Cos	Programme Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	3	2
CO2	3	3	3	3	3
CO3	3	3	3	2	3
CO4	3	3	3	3	3
CO5	3	2	3	2	3

Course Assessment methods

Direct		Indirect
Review I -5 marks Review II -10 marks Review III -15 marks Final Project Report -10 marks	Total CIE: 40 marks Semester End Examination: 60 marks	Course end survey

In Project work-I each student focuses on fundamental skills and research area. They acquire proficiency in research methodologies, conducting surveys, and reviewing literature to recognize challenges. Additionally, they cultivate skills in project planning and execution. Students also learn to select computational tools for system analysis and to design experiments. The importance of communication skills, both oral and written, is stressed to enhance the ability to convey technical content effectively. This introductory stage establishes the foundation for advanced project work, blending theoretical knowledge with practical applications in computer science engineering.

Theory: 0 Hrs	Tutorial: 0	Practical: 0	Project: 240 Hrs	Total Hours: 240 Hrs

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Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for M.E/M.Tech. Semester IV under Regulations 2023 (CBCS)
Branch: Computer Science and Engineering

S.No	Course Code	Course Title	L	T	P	J	C	Category	Total Contact Hours	Course Type*
Practical courses										
1.	P23CSE401	Project Work-II	0	0	0	28	14	PC	420	P
						Total Credits	14			

*T- Theory, TT- Theory with Tutorial, TL- Theory with Laboratory, TP- Theory with Project, TLP- Theory with Laboratory and Project, L-Laboratory, LT- Laboratory with Theory, LP- Laboratory with Project

Approved By

Chairperson, Computer Science and Engineering BoS	Member Secretary, Academic Council	Dean-Academics	Chairperson, Academic Council & Principal
Dr.B.Sathiyabhama	Dr.R.Shivakumar	Dr.J.Akilandeswari	Dr.S.R.R.Senthil Kumar

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P23CSE401	PROJECT WORK-II	L	T	P	J	C
		0	0	0	28	14

Course Outcomes

At the end of the course, the student will be able to

CO1:	Identify the research problems addressing emerging challenges and opportunities in the computer science engineering field
CO2:	Design and develop innovative solution to solve the research problem identified with latest technology and tools
CO3:	Apply analytical methods to assess and improve project outcomes and processes

Pre-requisite:

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	3	2
CO2	3	3	3	3	3
CO3	3	3	3	2	3
CO4	3	3	3	3	3
CO5	3	2	3	2	3

Course Assessment methods

Direct		Indirect
Review I - 5 Marks Review II -10 Marks Review III-15 Marks Final Project Report – 10 Marks	Total CIE: 40 marks Project Viva voce (60)	Course end survey

1. Project Work–II, which is a continuation of Project Work–I, (except when project work II is carried out in the industry) is to be undertaken during Semester IV
2. Every student must submit a project report at the end of Semester IV for evaluation.
3. Three reviews must be conducted by a committee consisting of the Project Coordinator (appointed by HOD), Project supervisor and one senior faculty member of the respective department will carry out the CIE assessment.
4. Each student of M. E / M. Tech shall publish at least ONE paper in Refereed International Journals (Scopus Indexed) / International Conferences (Scopus Indexed) during Project work Phase-II.

Theory: -	Tutorial: --	Practical: --	Project:420	Total Hours: 420 Hrs

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