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 2023-2024]

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.	P23CSE501	**Elective:** Cloud Computing	3	0	0	0	3	PE	45	T
4.	P23CSE507	**Elective:** Machine Learning	3	0	0	0	3	PE	45	T
5.	P23CSE513	**Elective:** Big 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
9.										
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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HOD/ CSE, Second Semester ME CSE Students and Staff, COE

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

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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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HoD / Mathematics	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.

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

S. Padma 4.8.23

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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

HOD
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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.	P23CSE501	**Elective:** Cloud Computing	3	0	0	0	3	PE	45	T
4.	P23CSE507	**Elective:** Machine Learning	3	0	0	0	3	PE	45	T
5.	P23CSE513	**Elective:** Big 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
9.										
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 -- 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, Second Semester ME 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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P23CSE501	CLOUD COMPUTING	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 key technologies involved in operation of network system.
CO2:	Analyze the complexity involved in virtualization
CO3:	Evaluate the suitability of each service model for various application scenarios and business requirements.
CO4:	Analyze the various interoperability and storage issues in modern cloud platforms
CO5:	Analyze security models and mechanisms for establishing trust relationship in cloud environment.

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 DISTRIBUTED SYSTEMS AND ENABLING TECHNOLOGIES — **9 Hours**

Technologies for network based systems - System Models for Distributed and Cloud Computing - Clustering for Massive Parallelism - Design Principles of Computer Clusters - Cluster Job and Resource Management

UNIT 02 VIRTUALIZATION — **9 Hours**

Implementation Levels of Virtualization - Virtualization Structures, Tools and Mechanisms - Virtualization of CPU, Memory, and I/O Devices - Virtual Clusters and Resource Management - Virtualization for Data-Center Automation

UNIT 03 CLOUD DEVELOPMENT ENVIRONMENT — **9 Hours**

Characteristics - Service Models: IaaS, PaaS, SaaS - Deployment Models: Public, Private, Community, Hybrid Clouds - Data-Center Design and Interconnection Networks - Architectural Design.

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Unit 04: CLOUD PLATFORMS AND SERVICES	**9 Hours**
Compute Services – Storage Services – Database Services – Application Services – Content Delivery Services – Analytics Services – Deployment and Management Services – Identity and Access Management Services – Open Source Private Cloud Softwares.	
Unit 05: CLOUD SECURITY AND INTER-CLOUD	**9 Hours**
Trust Management - Defense Strategies - Distributed Intrusion/Anomaly Detection - Data and Software Protection Techniques - Reputation-Guided Protection of Data Centers - Inter-cloud Resource Management.	

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

REFERENCES

1.	Kai Hwang, Geoffrey C Fox, Jack J Dongarra, "Distributed and Cloud Computing From Parallel Processing to the Internet of Things", Morgan Kauffman imprint of Elsevier, 2012..
2.	Arshdeep Bahga, Vijay Madisetti, "Cloud Computing: A Hands-On Approach", Universities Press (India) Private Limited, 2014.
3.	James E Smith and Ravi Nair, "Virtual Machines", Elsevier, 2005.
4.	Thomas Erl, Zaigham Mahood, Ricardo Puttini, "Cloud Computing, Concept, Technology & Architecture", Prentice Hall, 2013.
5.	Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing", Tata McGraw-Hill, 2013
6.	Toby Velte, Anthony Velte, Robert C. Elsenpeter, "Cloud Computing, A Practical Approach",Tata McGraw-Hill Edition, 2010.
7.	John Rittinghouse and James Ransome, "Cloud Computing Implementation, Management and Security", CRC Press, 2010

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P23CSE507	MACHINE LEARNING	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 machine learning basics.
CO2:	Implement supervised learning algorithms for the given application and analyze the results.
CO3:	Use tools to implement typical clustering algorithms for different types of applications.
CO4:	Design and implement an HMM for a sequence model type of application.
CO5:	Apply the advanced learning algorithms to solve complex MC problems.

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**

Machine Learning - Machine Learning Foundations – Overview – Design of a Learning system - Types of machine learning – Applications Mathematical foundations of machine learning - random variables and probabilities -Probability Theory – Probability distributions - Decision Theory - Bayes Decision Theory - Information Theory.

Unit 02: SUPERVISED LEARNING — **9 Hours**

Linear Models for Regression - Linear Models for Classification – Naïve Bayes - Discriminant Functions - Probabilistic Generative Models - Probabilistic Discriminative Models - Bayesian Logistic Regression. Decision Trees - Classification Trees-Regression Trees - Pruning. Neural Networks - Feed-forward Network Functions - Back-propagation. Support vector machines - Ensemble methods - Bagging-Boosting.

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Unit 03: UNSUPERVISED LEARNING	9 Hours
Clustering - K-means - EM Algorithm - Mixtures of Gaussians. The Curse of Dimensionality - Dimensionality Reduction - Factor analysis - Principal Component Analysis - Probabilistic PCA - Independent components analysis.	
Unit 04: PROBABILISTIC GRAPHICAL MODELS	**9 Hours**
Graphical Models -Undirected graphical models-Markov Random Fields -Directed Graphical Models - Bayesian Networks -Conditional independence properties -Inference –Learning-Generalization -Hidden Markov Models -Conditional random fields (CRFs).	
Unit 05: ADVANCED LEARNING	**9 Hours**
Sampling –Basic sampling methods –Monte Carlo. Reinforcement Learning-K-Armed Bandit-Elements - Model-Based Learning-Value Iteration-Policy Iteration. Temporal Difference Learning-Exploration Strategies-Deterministic and Non-deterministic Rewards and Actions Computational Learning Theory - Mistake bound analysis, sample complexity analysis, VC dimension. Occam learning, accuracy and confidence boosting.	

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

REFERENCES

1.	Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2007.
2.	Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
3.	Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014.
4.	Jure Leskovec, Anand Rajaraman and Jeffrey D. Ullman,"Mining of Massive Datasets", Cambridge University Press, Second Edition.
5.	Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.
6.	Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer, Second Edition, 2011.
7.	Stephen Marsland, "Machine Learning -An Algorithmic Perspective", Chapman and Hall/CRC Press, Second Edition, 2014

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P23CSE513	BIG 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:	Work with big data platform and explore the big data analytics techniques business applications
CO2:	Design efficient algorithms for mining the data from large volumes
CO3:	Analyze the HADOOP and Map Reduce technologies associated with big data analytics
CO4:	Explore on Big Data applications Using Pig and Hive
CO5:	Analyze the data using regressions and visualization techniques

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 TO BIG DATA — **9 Hours**

Introduction to Big Data Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting. .

Unit 02: MINING DATA STREAMS — **9 Hours**

Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis- Stock Market Predictions.

Unit 03: HADOOP — **9 Hours**

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History of Hadoop- the Hadoop Distributed File System – Components of Hadoop Analysing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS Basics- Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features-Hadoop environment				
Unit 04: FRAMEWORKS				**9 Hours**
Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM InfoSphere BigInsights and Streams				
Unit 05: PREDICTIVE ANALYTICS				**9 Hours**
Simple linear regression- Multiple linear regression- Interpretation 5 of regression coefficients. Visualizations - Visual data analysis techniques- interaction techniques - Systems and applications.				
Theory: 45 Hrs	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total Hours: 45 Hrs**

REFERENCES

1.	Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2.	Tom White "Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012
3.	Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012
4.	Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP, 2012.
5.	Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley& sons, 2012
6.	Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007
7.	Pete Warden, "Big Data Glossary", O'Reilly, 2011
8.	Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", 2 nd Edition, Elsevier, Reprinted 2008.
9.	Jiawei Han, MichelineKamber, Jian Pei, "Data Mining Concepts and Techniques", Morgan Kaufman Publications, Third Edition, 2011
10	Arshdeep Bahga, Vijay Madisetti, "Big Data Science & Analytics: A HandsOn Approach ",VPT, 2016

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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

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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

HOD

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