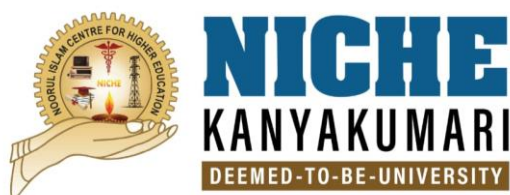


NOORUL ISLAM CENTRE FOR HIGHER EDUCATION

(Deemed to be University Under Section 3 of the UGC Act, 1956)
Kumaracoil, Thuckalay

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING



M.E. COMPUTER SCIENCE AND ENGINEERING **CURRICULUM AND SYLLABI**

REGULATION 2021

NOORUL ISLAM CENTRE FOR HIGHER EDUCATION, Kumaracoil

Regulation : 2021

Curriculum and Syllabi

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M.E. COMPUTER SCIENCE AND ENGINEERING

Vision of the University

To be recognized by the Government and society at large as an institution able to deliver excellence with relevance in the field of higher education and research focusing on the needs of the nation in tune with the technological revolution to cope with the knowledge explosion and global competence.

Mission of the University

To develop the institution as a Centre of Excellence, keeping pace with the advances in the field, so as to provide quality higher education to the students and instill in them high standards of discipline and ethics so that they become enlightened individuals in the service of humanity and to carry out focused research in the frontier areas of science and technology.

Faculty of Information and Computer Engineering

Department of Computer Science and Engineering

Vision of the Department

To offer the most conducive environment for quality academic and research oriented undergraduate and postgraduate education in computer science and engineering and prepare the students for a globalised technological society and orient them towards serving the society.

Mission of the Department

- Impart high quality professional training at the undergraduate and postgraduate level with an emphasis on basic principles of computer science and engineering.
- Empower the students with the required skills to solve the complex technological problems of modern society and also provide them with a framework for promoting collaborative and multidisciplinary activities.
- Conduct research to advance the state of the art in computer science and integrate research results and innovations into other scientific disciplines.

Description of the programme

Master of Engineering in Computer Science and Engineering is a 2-year program that includes all the advanced theoretical and technical aspects of computer science, engineering, and architecture. This involves programming and also more advanced topics like Cloud computing, data science, artificial intelligence, cybersecurity, and IoT. The curriculum and syllabus are on par with the best universities in the country.

Master of Engineering in Computer Science and Engineering prepares the students for research activities and for the role of teacher. The field of computer science and engineering prioritizes computer design and software development, with a heavier emphasis on computing theory, emanating to a greater focus on cybersecurity, algorithms, and computer networks.

Students completing this computer science and engineering degree can pursue Research work , take job as computer systems analysts, helping to build and maintain complex technological systems. The job profiles are Software Developer, System Designer, Software Engineer Research Analyst, and the highly paid job profiles like Data Scientist and Machine Learning experts are on the rise.

Programme Educational Objectives - PEO	
PEO-01	Graduates can develop proficiency as a computer science engineer with an ability to solve a wide range of computational problems and have sustainable development in industry or any other work environment.
PEO-02	Graduates can analyze and adapt quickly to new environments and technologies, gather new information, and work on emerging technologies to solve multidisciplinary engineering problems.
PEO-03	Graduates can possess the ability to think analytically and logically to understand technical problems with computational systems for a lifelong learning which leads to pursuing research
PEO-04	Graduates can adopt ethical practices to collaborate with team members and team leaders to build technology with cutting-edge technical solutions for computing systems
PEO-05	Graduates can strongly focus on design thinking and critical analysis to create innovative products and become entrepreneurs.

Graduate Attributes-GA	
GA-1	Advanced Engineering Expertise Master advanced engineering principles and apply them to design, analyze, and innovate systems that address both present and emerging global challenges across diverse industries.
GA-2	Leadership in Research and Innovation Lead groundbreaking research and foster innovation by identifying opportunities for technological advancements, contributing original ideas that push the boundaries of engineering knowledge.
GA-3	Sustainable Engineering Practices Develop and implement engineering solutions that integrate sustainability, environmental stewardship, and resource efficiency, ensuring the long-term impact and responsibility of all projects.
GA-4	Ethical and Strategic Decision-Making Make informed, ethical decisions in complex engineering contexts, considering societal needs, environmental implications, and the long-term consequences of engineering practices.
GA-5	Global Competence in Engineering Solutions Exhibit a deep understanding of global engineering standards and practices, addressing international challenges and cultural sensitivities in engineering projects to make a broader societal impact.
GA-6	Technological Agility and Lifelong Learning Stay ahead of technological trends and exhibit agility in learning new tools, methodologies, and technologies, ensuring continuous professional growth in a rapidly evolving engineering landscape.
GA-7	Interdisciplinary and Collaborative Innovation Excel in multidisciplinary collaborations, leveraging knowledge from multiple fields to solve complex, large-scale engineering problems that require comprehensive and innovative solutions.
GA-8	Data-Driven Decision Making Employ advanced data analytics, machine learning, and computational tools to derive insights and make informed engineering decisions that improve
GA-9	Entrepreneurial Mindset and Innovation Leadership Cultivate an entrepreneurial mindset, translating engineering innovations into viable products, solutions, or services, and leading teams toward commercialization and societal impact.
GA-10	Safety, Risk, and Crisis Management Implement and manage advanced safety protocols and risk mitigation strategies to protect individuals, communities, and ecosystems in engineering practices, particularly in high-stakes and crisis environments.

Programme Outcome – POs

Programme Outcome – PO	
PO-A	Apply the knowledge of mathematical foundations and computer science & engineering concepts to solve complex problems related to design, development, testing and maintenance of computing systems.
PO-B	Ability to identify, formulate and analyze complex problems in computer based applications.
PO-C	Manage effectively on teams to accomplish a common goal.
PO-D	Apply professional ethics and agree to the norms or responsibilities in engineering practice of computer science.
PO-E	Communicate effectively and prepare technical documents and oral presentations.
PO-F	Ability to use current techniques, skills and state-of-art tools for computing system.
PO-G	Ability to apply design and development principles in the construction of software systems and in the allied engineering application domains.

Mapping of Graduate Attributes and Programme Educational Objectives(PEO)

GA PEOs	GA-01	GA-02	GA-03	GA-04	GA-05	GA-06	GA-07	GA-08	GA-09	GA-10
PEO-01	H	A	H	A	A	A	A	A	A	A
PEO-02	A	A	A	A	H	A	H	A	A	A
PEO-03	A	A	A	A	H	A	A	A	A	A
PEO-04	H	A	A	A	H	A	A	H	A	A
PEO-05	H	A	A	A	H	H	A	H	H	A
H- Highly Associated		A- Associated				Not – Not Associated				

Mapping of Graduate Attributes and Programme Outcomes (PO)

GAs POs	G A-01	GA-02	GA-03	GA-04	GA-05	GA-06	GA-07	GA-08	GA-09	GA-10
PO-A	H	A	H	A	A	A	A	A	A	A
PO-B	H	A	A	A	A	A	A	A	H	A
PO-C	A	A	A	A	A	H	H	H	A	A
PO-D	A	A	A	H	A	A	A	H	A	A
PO-E	A	A	A	A	A	A	A	A	A	A
PO-F	H	A	A	A	A	A	A	A	H	A
PO-G	A	H	H	A	A	A	A	A	A	A

H- Highly Associated

A- Associated

Not – Not Associated

Mapping of Programme Educational Objective (PEOs) and Programme Outcomes (POs)

PEO PO	PEO-01	PEO-02	PEO-03	PEO-04	PEO-05
PO-A	H	H	A	A	A
PO-B	H	H	H	A	A
PO-C	A	A	A	H	H
PO-D	A	A	A	A	A
PO-E	A	A	A	A	A
PO-F	A	H	A	H	A
PO-G	A	H	A	A	H

H- Highly Associated

A- Associated

Not – Not Associated

Duration of the programme: 2 Years/4 Semesters

Total credit :

Semester	I	II	III	IV	Total
Total Credits	21	22	10	16	69

CURRICULUM & SYLLABI

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	MA3505	Operation Research	4	0	0	4
2.	CS3501	Advanced Data Structures & Algorithms	3	0	0	3
3.	CS3502	Advanced Operating Systems	3	0	0	3
4.	PEC	Elective – I	3	0	0	3
5.	PEC	Elective – II	3	0	0	3
6.	CS35C3	Disaster Management	3	0	0	3
PRACTICAL						
7.	CS3571	Advanced Operating System Laboratory	0	0	2	1
8.	CS3572	Advanced Data Structures and Algorithms Laboratory	0	0	2	1
Total Credits						21

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	CS3503	Data Science	3	0	0	3
2.	CS3504	Cloud Computing Tools And Techniques	3	0	0	3
3.	CS3505	Advanced Database Management System	3	0	0	3
4.	PEC	Elective – III	3	0	0	3
5.	PEC	Elective – IV	3	0	0	3
6.	CS35C4	Web Engineering	3	0	0	3
PRACTICAL						
7.	CS3573	Data Science Laboratory	0	0	2	1
8.	CS3574	Cloud Computing Laboratory	0	0	2	1
9.	CS35P1	Mini Project	2	0	0	2
Total Credits						22

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	CS3506	Ethical Hacking	3	0	0	3
2.	CS3507	Parallel & Distributed Databases	3	0	0	3
PRACTICAL						
2.	CS35P2	Project Phase – I	0	0	8	4
Total Credits						10

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	CS35P5	Project Phase – II	0	0	32	16
Total Credits						16

M.E. COMPUTER SCIENCE AND ENGINEERING**R2021 - ELECTIVE LIST**

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
Elective – I						
1.	CS35A1	Distributed Systems	3	0	0	3
2.	CS35A2	Data Preparation and Analysis	3	0	0	3
3.	CS35A3	Digital Image Processing and Applications	3	0	0	3
4.	CS35A4	Bio Informatics	3	0	0	3
5.	CS35A5	Embedded Systems	3	0	0	3
Elective – II						
1.	CS35A6	Machine Learning	3	0	0	3
2.	CS35A7	Data Storage Technologies and Networks	3	0	0	3
3.	CS35A8	Data Mining Techniques	3	0	0	3
4.	CS35A9	Software Quality Assurance	3	0	0	3
5.	CS35B1	Parallel Algorithms	3	0	0	3
Elective – III						
1.	CS35B2	Data Visualization	3	0	0	3
2.	CS35B3	Big Data Analytics	3	0	0	3
3.	CS35B4	Data Warehousing and Data Mining	3	0	0	3
4.	CS35B5	Social Network Analysis	3	0	0	3
5.	CS35B6	Virtualization Techniques	3	0	0	3
Elective – IV						
1.	CS35B7	Internet of Things	3	0	0	3
2.	CS35B8	Web Content Design and Management	3	0	0	3
3.	CS35B9	Database Administration and Tuning	3	0	0	3
4.	CS35C1	Information Retrieval Techniques	3	0	0	3
5.	CS35C2	Service Oriented Architecture & Design	3	0	0	3

SLNo	COURSE CODE	COURSE TITLE	L	T	P	C
Open Electives						
1.	CS35C3	Disaster Management	3	0	0	3
2.	CS35C4	Web Engineering	3	0	0	3

Semester I

MA3505	OPERATIONS RESEARCH	L	T	P	C
		3	1	0	4

AIM:

The probabilistic models are applicable in all areas of computer science. This course provides necessary mathematical support to solve real life problem.

OBJECTIVE:

To develop mathematical skill to analyze various complex problems and to study the applications of operations research in functional areas of computing like network scheduling, queueing and simulation.

Subject Code: MA3505 Subject Name: OPERATIONS RESEARCH		
Course Outcome – Cos, Students able to		Cognitive Skill
CO-01	Understand the formulation and assignment problems in linear programming.	U, A ,E, R
CO-02	Define the definitions of dynamic programming and understand the applications , problems in dynamic programming.	U, A ,E, An
CO-03	Know about the Queuing models, formulas and series in queuing problems.	U, A ,E, R
CO-04	Know the Fundamental of spanning problems, critical path methods and review techniques.	U, A , An,E
CO-05	Evaluate the simulations, know different type of simulations and its applications to queuing systems.	U, A , An,E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J	PO-k	PO-L
CO-01	S	M	S	M	S	S	S	L	M	L	L	M
CO-02	S	M	M	M	S	S	M	L	M	M	M	M
CO-03	S	M	M	M	S	S	M	M	M	L	L	M
CO-04	S	M	S	M	S	M	S	L	M	L	L	M
CO-05	S	M	S	M	S	M	S	L	M	L	L	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I LINEAR PROGRAMMING

9

Formulation Graphical solution Simplex method Artificial variable technique - Two Phase method - Transportation and Assignment problems.

UNIT-II DYNAMIC PROGRAMMING

9

Bellmans principle of optimality Characteristics of the dynamic programming model The recursive equation We- Backward and Forward approach Applications of Dynamic programming problem in Allocation problems, Shortest route problem and Cargo loading Problem.

UNIT-III QUEUEING MODELS

9

Birth and Death Process - Poisson Process Markovian Queues Single Server Models Littles formula - Queues in Series Open Queueing Networks Closed Queueing networks.

UNIT-IV NETWORK MODEL

9

Shortest Route, Minimal Spanning tree and Maximal flow models Critical Path Method Project Evaluation and Review Technique.

UNIT-V SIMULATION

9

Discrete Event Simulation Stochastic Simulation - Monte Carlo Simulation Generation of Random Numbers using Congruent method Applications to Queueing systems.

L: 45 + T: 15, TOTAL: 60 HOURS

REFERENCES:

1. Taha, H.A. Operations Research: An Introduction, Ninth Edition, Pearson Education Edition, Asia, New Delhi, 2002.
2. Robertazzi. T.G. Computer Networks and Systems Queuing Theory and Performance Evaluation, Third Edition, Springer, 2002 Reprint.
3. S.S. Rao Optimization Techniques Prentice Hall of India , 2004.
4. J.K Sharma Operations Research Macmillan, 2003

CS3501	ADVANCED DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	0	3

OBJECTIVES

To understand the usage of algorithms in computing.

- To learn and use hierarchical data structures and its operations
- To learn the usage of graphs and its applications.
- To select and design data structures and algorithms that is appropriate for problems.
- To study about NP Completeness of problems.

Subject Code: CS3501		Subject Name: Advanced Data Structures and Algorithms	
Course Outcome – Cos			Cognitive Skill
CO-01	Design data structures and algorithms to solve computing problems		R, U
CO-02	Design advance data structure using Non-Linear data structure.		U, An
CO-03	Design algorithms using graph structure and various string matching algorithms to solve real-life problems		U, A, S
CO-04	Apply suitable design strategy for problem solving		U, A
CO-05	Have a basic ability to analyze algorithms and to determine algorithm correctness and time efficiency		U, A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO							
	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	M	L	N	S	S
CO-02	S	S	N	L	N	S	S
CO-03	M	S	N	N	N	S	M
CO-04	L	M	N	L	N	M	L
CO-05	L	L	N	L	M	M	N

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I ROLE OF ALGORITHMS IN COMPUTING

9

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 II HIERARCHICAL DATA STRUCTURES

9

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 III GRAPHS

9

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 Paths and Matrix Multiplication – The Floyd Warshall Algorithm.

UNIT IV ALGORITHM DESIGN TECHNIQUES

9

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 V NP COMPLETE AND NP HARD

9

NP-Completeness: Polynomial Time – Polynomial-Time Verification – NP- Completeness and Reducability – NP-Completeness Proofs – NP-Complete Problems.

TOTAL:45 HOURS

REFERENCES

1. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, Data Structures and Algorithms, Pearson Education, Reprint 2006.
2. Robert Sedgewick and Kevin Wayne, Algorithms, Fourth Edition, Pearson Education, March 2011
3. S.Sridhar, Design and Analysis of Algorithms, First Edition, Oxford University Press. 2014.
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, Third Edition, Prentice-Hall, 2011.

CS3502	ADVANCED OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concepts of distributed systems
- To get an insight into the various issues and solutions in distributed operating systems
- To learn about mobile and real-time operating systems
- To gain knowledge on the design concepts of mainframe operating systems

Subject Code:CS3502		Subject Name: Advanced Operating Systems	
Course Outcome – Cos			Cognitive Skill
CO-01	Understand the process its execution and deadlocks in operating systems.		U, R
CO-02	Apply the operating system concepts in distributed operating system.		A
CO-03	Evaluate and synthesis the recent features in DOS.		E, S
CO-04	Remember and Analyze the concepts of ROS and analyzing its role in mobile applications.		R, An
CO-05	Remember mainframe concepts and application of ZOS.		R

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	L	M	M	L	S
CO-02	M	S	L	S	S	L	M
CO-03	S	S	M	S	S	S	M
CO-04	M	S	L	S	M	L	S
CO-05	S	L	M	S	M	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I BASICS OF OPERATING SYSTEMS

9

Overview- Synchronization Mechanisms Processes and Threads- Process Deadlocks - Issues in- Distributed Operating Systems Communication Primitives Limitations of a Distributed System.

UNIT-II DISTRIBUTED OPERATING SYSTEMS

9

Lamports-Logical Clocks - Vector Clocks - Causal Ordering of Messages - Distributed Mutual Exclusion Algorithms-Centralized, Distributed and Hierarchical Deadlock Detection Algorithms Agreement Protocols.

UNIT-III DISTRIBUTED RESOURCE MANAGEMENT

9

Distributed File Systems- Design Issues - Google File System- Hadoop Distributed File System Distributed Shared Memory - Algorithms for Implementing Distributed Shared Memory - Load Distributed Algorithms- Issues in Task Migration - Synchronous and Asynchronous Check Pointing and Recovery - Fault Tolerance - Two-Phase Commit Protocol- Nonblocking Commit Protocol.

UNIT-IV MOBILE AND REAL TIME OPERATING SYSTEMS

9

Basic Model of Real Time Systems – Characteristics - Applications of Real Time Systems - Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems - Architecture Layers - Microkernel Design - Kernel Extensions - Processes and Threads - Memory Management - File system - Android iOS.

UNIT-V MAINFRAME AND LINUX OPERATING SYSTEMS

9

Mainframe z/OS - Overview of z/OS - Facilities - Virtual Storage and other Mainframe Concepts-Workload Management - I/O and Data Management - Supervising the Execution of Work in the System Cross-memory Services - Characteristics of z/OS. Linux Design Principles Kernel Modules - Process Management - Scheduling - Memory Management - I/O Management - File System - Interprocess Communication

TOTAL: 45 HOURS

REFERENCES

1. Mukesh Singhal, Niranjana Shivaratri, Advanced Concepts in Operating Systems Distributed, Database and Multiprocessor Operating Systems, Tata McGraw-Hill, 2001.
2. Rajib Mall, Real-Time Systems: Theory and Practice, Prentice Hall, 2006.
3. Neil Smyth, iPhone iOS 4 Development Essentials Xcode, Payload Media, Fourth Edition, 2011.
4. Nikolay Elenkov, Android Security Internals: An In-Depth Guide to Androids Security Architecture, No Starch Press, 2014.
5. Jonathan Levin, Mac OS X and iOS Internals: To the Apples Core, John Wiley & Sons, 2012.
6. Andrew S. Tanenbaum and Herbert Bos, Modern Operating Systems, Fourth Edition, Prentice Hall, 2014.
7. Mike Ebberts, John Kettner, Wayne OBrien, Bill Ogden, Introduction to the New Mainframe: z/OS Basics, Third Edition, International Business Machines Corporation, 2011.
8. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Concepts, Wiley, Eighth edition, 2008.

CS3571	ADVANCED OPERATING SYSTEM LABORATORY	L	T	P	C
		0	0	2	1

AIM

This lab complements the operating systems course.

OBJECTIVES

- Students will gain practical experience with designing and implementing concepts of operating systems such as system calls, CPU scheduling, process management,
- memory management, file systems and deadlock handling .

Subject Code: CS3571		Subject Name: Advanced Operating System Laboratory	
Course Outcome – Cos		Cognitive Skill	
CO-01	Understand and implement basic services and functionalities of the operating system using system calls.	U	
CO-02	Use modern operating system calls and synchronization libraries in software/ hardware interfaces.	A	
CO-03	Understand the benefits of thread over process and implement synchronized programs using multithreading concepts.	An	
CO-04	Analyze and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, and Priority	E	
CO-05	Implement memory management schemes and page replacement schemes	A	

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO						
	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	M	S	S	M	L	S
CO-02	S	M	S	S	M	N	S
CO-03	S	M	S	S	M	L	S
CO-04	S	M	N	S	M	L	S
CO-05	S	M	S	S	M	L	S

S- Strong, M- Medium, L-Low, N- Not Relevant

(Implement the following using any High Level Language)

LIST OF EXPERIMENTS

1. Simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time. a) FCFS b) SJF c) Round Robin (pre-emptive) d) Priority
2. Simulate multi-level queue scheduling algorithm considering the following scenario. All the processes in the system are divided into two categories – system processes and user processes. System processes are to be given higher priority than user processes. Use FCFS scheduling for the processes in each queue.

3. Simulate the following file allocation strategies. a) Sequential b) Indexed c) Linked
4. Simulate the MVT and MFT memory management techniques.
5. Simulate the following contiguous memory allocation techniques
a)Worst-fit b) Best-fit c) First-fit
6. Simulate paging technique of memory management.
7. Simulate the following file organization techniques a) Single level directory b) Two level directory c) Hierarchical
8. Simulate Bankers algorithm for the purpose of deadlock avoidance.
9. Simulate disk scheduling algorithms a) FCFS b) SCAN c) C-SCAN
10. Simulate page replacement algorithms a) FIFO b) LRU c) LFU
11. Simulate page replacement algorithms a) Optimal
12. Simulate producer-consumer problem using semaphores.
13. Simulate the concept of Dining-Philosophers problem

CS3572	ADVANCED DATA STRUCTURES AND ALGORITHMS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To understand heap and various tree structures like AVL, Red-black, B and Segment trees.
- To understand the problems such as line segment intersection, convex shell and Voronoi diagram.

Subject Code:CS3572 Subject Name: Advanced Data Structures & Algorithms Laboratory		
Course Outcome – Cos		Cognitive Skill
CO-01	Understand the various types of data structures	U
CO-02	Design and Apply of AVL Trees and its Operations	A
CO-03	Analyzing the various Heap algorithms.	An
CO-04	Design of different tree structures, convex hull, voronoi diagram and evaluate it.	E
CO-05	Apply the appropriate data structure for a given problem	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

MAPPING OF COURSE OUTCOME WITH PROGRAMME OUTCOME

CO\PO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	M	S	M	S	L	L
CO-02	M	S	S	S	M	S	S
CO-03	S	L	S	M	L	L	M
CO-04	L	M	M	S	N	S	S
CO-05	S	S	L	L	L	M	M

S-Strong, M-Medium, L-Low, N-Not Relevant

(Implement the following using any High level language)

LIST OF EXPERIMENTS

1. Min/Max Heap
2. Leftist Heap
3. AVL Trees
4. Red-Black Trees
5. B-Trees
6. Segment Trees
7. Line Segment intersection
8. Convex Hull
9. Voronoi Diagram

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	CS3503	Data Science	3	0	0	3
2.	CS3504	Cloud Computing Tools And Techniques	3	0	0	3
3.	CS3505	Advanced Database Management System	3	0	0	3
4.	PEC	Elective – III	3	0	0	3
5.	PEC	Elective – IV	3	0	0	3
6.	OEC	Open Elective-II	3	0	0	3
PRACTICAL						
7.	CS3573	Data Science Laboratory	0	0	2	1

8.	CS3574	Cloud Computing Laboratory	0	0	2	1
9.	CS35P1	Mini Project	2	0	0	2
Total Credits						22

CS3503	DATA SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES

- Building the fundamentals of data science.
- Gaining practical experience in programming tools for data sciences
- Empowering students with tools and techniques used in data science

Subject Code: CS3503		Subject Name: Data Science	
Course Outcome – Cos			Cognitive Skill
CO-01	Understand the Evolution and Applications of Data Science		U
CO-02	Apply data collection and pre-processing techniques		A
CO-03	Analyze EDA, inference and regression techniques		An
CO-04	Utilize Model Evaluation using Visualization techniques		U
CO-05	Analyze the regression techniques in Model Evaluation		An

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	M	M	S	S	M	M	M
CO-02	S	L	S	S	M	L	L
CO-03	S	M	S	S	M	M	L
CO-04	S	M	S	S	M	M	M
CO-05	M	M	S	S	M	M	M

S-Strong, M-Medium, L-Low, N-Not relevant

Unit – I: Introduction **9**

Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.

Unit – II: Data Collection and Data Pre-Processing **9**

Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

Unit – III: Exploratory Data Analytics **9**

Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.

Unit – IV: Model Development **9**

Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making.

Unit – V: Model Evaluation **9**

Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Overfitting – Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search.

REFERENCES

1. Jojo Moolayil, “Smarter Decisions : The Intersection of IoT and Data Science”, PACKT, 2016.
2. Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O’Reilly, 2015.
3. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013
4. Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI Global.

CS3504	CLOUD COMPUTING TOOLS AND TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- This course gives students an insight into the basics of cloud computing along with virtualization
- Cloud computing is one of the fastest growing domain from a while now. It provide the architectural insights and limitations in cloud.

- Provides basic understanding about cloud and virtualization along with it how one can migrate over it.

Subject Code: CS3504		Subject Name: Cloud Computing Tools And Techniques	
Course Outcome – Cos			Cognitive Skill
CO-01	Understand the basics of cloud computing along with virtualization.		U
CO-02	Analyze the cloud insights, benefits and limitations of cloud computing.		An
CO-03	Evaluate the Cloud Architecture- Layers and Models		E
CO-04	Understand and Apply the different cloud simulators.		U,A
CO-05	Analyze the working of VMWare Simulators.		An

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO- A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	M	L	S	L	N	S	L
CO-02	N	S	L	S	M	S	M
CO-03	S	M	M	M	M	S	M
CO-04	M	M	L	M	L	S	S
CO-05	M	M	S	S	S	S	M

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I: Cloud Computing Overview

Origins of Cloud computing – Cloud components - Essential characteristics – On-demand self service, Broad network access, Location independent resource pooling ,Rapid elasticity , Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing.

UNIT II: Cloud Insights

Architectural influences – High-performance computing, Utility and Enterprise grid computing, Cloud scenarios – Benefits: scalability ,simplicity ,vendors ,security, Limitations – Sensitive

information - Application development- security level of third party - security benefits, Regularity issues: Government policies.

UNIT III: Cloud Architecture- Layers and Models

Layers in cloud architecture, Software as a Service (SaaS), features of SaaS and benefits, Platform as a Service (PaaS), features of PaaS and benefits, Infrastructure as a Service (IaaS), features of IaaS and benefits, Service providers, challenges and risks in cloud adoption. Cloud deployment model: Public clouds – Private clouds – Community clouds - Hybrid clouds - Advantages of Cloud computing.

UNIT IV: Cloud Simulators- CloudSim and GreenCloud

Introduction to Simulator, understanding CloudSim simulator, CloudSim Architecture(User code, CloudSim, GridSim, SimJava) Understanding Working platform for CloudSim, Introduction to GreenCloud

UNIT V: Introduction to VMWare Simulator

Basics of VMWare, advantages of VMware virtualization, using VMware workstation, creating virtual machines-understanding virtual machines, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine.

REFERENCES

1. Anthony T.Velte , Toby J. Velte Robert,Elsepeter Cloud computing a practical approach , TATA McGraw- Hill , New Delhi – 2010
2. Michael Miller - Que ,Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - 2008
3. Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, Cloud computing for Dummies- Wiley Publishing, Inc, 2010
4. Rajkumar Buyya, James Broberg, Andrzej Goscinski, John , Cloud Computing (Principles and Paradigms), Edited by Wiley & Sons, Inc. 2011

CS3505	ADVANCED DATABASE MANAGEMENT SYSTEM	L	T	P	C
		3	0	0	3

AIM

To understand and design the basic and advanced DBMS techniques

OBJECTIVES

- To understand the basic concepts and terminology related to DBMS and Relational Database Design.
- To the design and implement Distributed Databases.

- To understand advanced DBMS techniques to construct tables and write effective queries, forms, and reports

Subject Code: CS3505		Subject Name: Advanced Database Management System	
Course Outcome – Cos			Cognitive Skill
CO-01	Understand the basics of DBMS and Relational Database Design.		U
CO-02	Analyze the normalization and query processing techniques		An
CO-03	Evaluate the complex queries including full outer joins, self-join, sub queries, and set theoretic queries.		E
CO-04	Understand and Apply the concurrency control and locking protocols		U,A
CO-05	Analyze the file organization, Query Optimization, Transaction management, and database administration techniques		An

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	L	S	L	N	S	S
CO-02	S	L	S	L	L	S	S
CO-03	S	S	S	M	S	L	S
CO-04	S	M	S	M	S	N	S
CO-05	S	L	S	M	S	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I

Formal review of relational database and FDs Implication, Closure, its correctness.

Unit II

3NF and BCNF, Decomposition and synthesis approaches, Review of SQL99, Basics of query processing, external sorting, file scans

Unit III

Processing of joins, materialized vs. pipelined processing, query transformation rules, DB transactions, ACID properties, interleaved executions, schedules, serialisability

Unit IV

Correctness of interleaved execution, Locking and management of locks, 2PL, deadlocks, multiple level granularity, CC on B+ trees, Optimistic CC

Unit V

T/O based techniques, Multiversion approaches, Comparison of CC methods, dynamic databases, Failure classification, recovery algorithm, XML and relational databases

References

1. R. Ramakrishnan, J. Gehrke, Database Management Systems, McGraw Hill, 2004
2. A. Silberschatz, H. Korth, S. Sudarshan, Database system concepts, 5/e, McGraw Hill, 2008.
3. K. V. Iyer, Lecture notes available as PDF file for classroom use.

CS3573	DATA SCIENCE LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES

The course should enable the students to:

- Understand the R Programming Language.
- Exposure on Solving of data science problems.
- Understand The classification and Regression Model

Subject Code: CS3573		Subject Name: Data Science Laboratory	
Course Outcome – Cos			Cognitive Skill
CO-01	Summarize the concepts for creating and displaying data		U

CO-02	Demonstrate the steps involved in the development of the system.	An
CO-03	Identify the relevant programming platform and toolbox to implement the pre and post processing techniques	E
CO-04	Analyze the problem thoroughly and identify the appropriate technique to design the model	U,An
CO-05	Design and implement the computing systems using appropriate technique and tools for any realworld application and recommend the best approach	An

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	M	S	S	S	M	L
CO-02	M	S	S	S	S	L	N
CO-03	L	M	S	S	S	M	L
CO-04	S	L	S	S	S	M	M
CO-05	M	S	S	S	S	M	L

LIST OF EXPERIMENTS

1. Creating and displaying data.
2. Descriptive statistics
3. Reading and writing different types of datasets
4. Visualization effects
5. Correlation and covariance
6. Regression model
7. Multiple regression model
8. Regression model for prediction
9. Classification model
10. Clustering model
11. Plotting with layers

12. Overriding aesthetics

13. Histograms and density charts

CS3574	CLOUD COMPUTING LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES

- To understand the installation of hypervisors
- To understand the installation of different cloud simulation tools and cloud setup tools
- To deploy cloud services

Subject Code: CS3574		Subject Name: CLOUD COMPUTING LABORATORY	
Course Outcome - COs		Cognitive Skill	
CO-01	Run the application on the instantiated VMs over different hypervisors.	R, U, A, E	
CO-02	Simulate their sample proposed systems	R, U, A, E	
CO-03	Set up a private cloud with open source cloud tool and deploy simple cloud services.	R, U, A, E	
CO-04	Develop MapReduce application using Hadoop setup.	R, U, A, E	
CO-05	Install various software packages	R, U, A, E	

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	L	M	S	S	S
CO-02	S	M	S	S	M	S	S
CO-03	M	S	S	S	L	M	S
CO-04	M	M	M	L	S	S	S
CO-05	S	S	N	L	L	L	S

S-Strong, M-Medium, L-Low, N-Not relevant

LIST OF EXPERIMENTS

1. Installation of various hypervisors and instantiation of VMs with image file using open

- source hypervisors such as Virtual Box, VMWare Player, Xen and KVM.
2. Client server communication between two virtual machine instances, execution of chat application.
 3. Creation of simple network topology using open source network virtualization tools (like mininet and others).
 4. Implementation of simple network protocols using open source network controllers (like Open Daylight).
 5. Implementation of various scheduling mechanisms using open source cloud simulator.
 6. Familiarization and usage of the following cloud services with open source cloud tools (like Eucalyptus, Openstack, Open Nebula and others)
 - a) scheduling mechanisms
 - b) load balancing mechanisms
 - c) hashing and encryption mechanisms
 7. Familiarization and usage of collaborative applications (SaaS).
 8. Implementing applications using Google App Engine (PaaS).
 9. Develop MapReduce application (example-URL Pattern count and others) using Hadoop cluster set up (Single node and multi node).

Semester III

CS3506	ETHICAL HACKING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand and analyze Information security threats and counter measures
- To perform security auditing & testing
- To understand issues relating to ethical hacking
- To study & employ network defense measures

Subject Code: CS3506		Subject Name: Ethical Hacking	
Course Outcome – Cos		Cognitive Skill	
CO-01	Understand and identify the vulnerabilities/threats/attacks.	R,U	
CO-02	Understand penetration and Apply security testing.	U,A	
CO-03	Analyze system hacking and implement various sniffing algorithms.	An	
CO-04	Evaluate and Define Web services and related flaws	E	
CO-05	Apply and design a computer against a variety of security attacks using various tools.	A	

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	M	S	S	S	M	L
CO-02	M	S	S	S	S	L	N
CO-03	L	M	S	S	S	M	L
CO-04	S	L	S	S	S	M	M
CO-05	M	S	S	S	S	M	L

T-Strong, M-Medium, L-Low, N-Not relevant

Unit I ETHICAL HACKING OVERVIEW & VULNERABILITIES

Understanding the importance of security-Concept of ethical hacking and essential Terminologies Threat- Attack- Vulnerabilities- Target of Evaluation -Exploit. Phases involved in hacking

UNIT II FOOTPRINTING & PORT SCANNING

9

Footprinting - Introduction to foot printing- Understanding the information gathering methodology of the hackers-Tools used for the reconnaissance phase. Port Scanning - Introduction- using port scanning tools- Ping sweepsScripting Enumeration-Introduction- Enumerating windows OS & Linux OS.

UNIT III SYSTEM HACKING

9

Aspect of remote password guessing- Role of eavesdropping -Various methods of password cracking- Keystroke Loggers- Understanding Sniffers - Comprehending Active and Passive Sniffing- ARP Spoofing and Redirection-DNS and IP Sniffing- HTTPS Sniffing

UNIT IV HACKING WEB SERVICES & SESSION HIJACKING

9

Web application vulnerabilities- Application coding errors- SQL injection into Back-end Databases- Cross-site scripting- cross-Site request forging-Authentication bypass- Web services and related flaws- Protective http headers Understanding Session Hijacking- Phases involved in Session Hijacking-Types of Session Hijacking- Session Hijacking Tools

UNIT V HACKING WIRELESS NETWORKS

9

Introduction to 802.11-Role of WEP- Cracking WEP Keys- SniffingTraffic- WirelessDOSattacks-WLANScanners-WLANSniffers-HackingTools-Securing Wireless Networks.

TOTAL : 45 PERIODS

REFERENCES

1. Kimberly Graves, "Certified Ethical Hacker", Wiley India Pvt Ltd, 2010.
2. Michael T. Simpson, "Hands-on Ethical Hacking & Network Defense", Course Technology, 2010
3. Patrick Engebretson, "The Basics of Hacking and Penetration Testing" Ethical Hacking and Penetration Testing Made Easy, Syngress Media, Second Revised Edition, 2013.
4. RajatKhare, "Network Security and Ethical Hacking", Luniver Press, 2006.
5. Ramachandran V, "Wireless Penetration Testing Beginner's Guide " 3rd ed.. Packt Publishing, 2011.
6. Thomas Mathew, "Ethical Hacking", OSB publishers, 2003.

CS3507	PARALLEL AND DISTRIBUTED DATABASES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To realize the need of parallel processing, to cater the applications that require a system capable of sustaining trillions of operations per second on very large data sets
- To understand the need of data integration over data centralization

Subject Code: CS3507 Subject Name: Parallel And Distributed Databases		
Course Outcome – Cos		Cognitive Skill
CO-01	Get good knowledge on the need, issues, design and application of both parallel and distributed databases.	R,U
CO-02	Know how to write optimal queries to cater applications of that need these forms of databases.	U,A
CO-03	Be able to fragment, replicate and localize their data as well as their queries to get their work done faster.	An
CO-04	Get idea on other similar trends of optimal data processing	E
CO-05	Apply transaction management and other advanced systems in data management.	A

Mapping of Course Outcome with Programme Outcome

PO CO	PO- A	PO- B	PO- C	PO- D	PO- E	PO- F	PO- G
CO-01	S	L	S	L	N	S	S
CO-02	S	L	S	L	L	S	S
CO-03	S	S	S	S	S	L	N
CO-04	S	M	S	M	S	S	S
CO-05	S	L	S	M	S	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I INTRODUCTION TO PARALLEL DATABASES 9

Need of Parallelism - Forms of parallelism – architecture – Analytical models. Basic Query

Parallelism – Parallel Search- Parallel sort and Group By- Parallel Join

UNIT II ADVANCED QUERY PROCESSING IN PARALLEL DATABASES 9

Parallel indexing. Parallel Universal Qualification – Collection Join Queries. Parallel Query Scheduling – Optimization, Applications

UNIT III INTRODUCTION TO DISTRIBUTED DATABASES 9

Overview - Promises of DDB –Design Issues – DDB Design – DDB Integration – Data and Access Control.

UNIT IV QUERY PROCESSING IN DISTRIBUTED DATABASES 9

Overview- of Query Processing – Query Decomposition and Data Localization – Optimization of Distributed Queries, Multi-database Query Processing.

UNIT V TRANSACTION MANAGEMENT AND OTHER ADVANCED SYSTEMS 9

Introduction – Concurrency Control - Distributed DBMS Reliability – Data Replication – DDB Applications, Distributed Object Database Management – Peer -to-Peer Data Management – Web Data Management – Streaming Data and Cloud Computing.

TOTAL : 45 PERIODS

REFERENCES:

1. David Taniar, Clement H.C.Leung, Wenny Rahayu, Sushant Goel , “High performance parallel Database processing and Grid databases” , John Wiley & Sons, Wiley Series in Parallel and Distributed Computing, 2008.
2. M. Tamer Ozsu and Patrick Valduriez, “Principles of Distributed Database Systems”, Springer Science + Business Media , 3rd Edition, 2011.

Elective – I

CS35A1	DISTRIBUTED SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the foundations of distributed systems.
- To learn issues related to clock Synchronization and the need for global state in distributed systems.
- To learn distributed mutual exclusion and deadlock detection algorithms.
- To understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems.
- To learn the characteristics of peer-to-peer and distributed shared memory systems.

Subject Code: CS35A1		Subject Name: Distributed Systems	
Course Outcome – Cos			Cognitive Skill
CO-01	Understand the basics of distributed computation.		R, U
CO-02	To get knowledge in message ordering and communication, global state and snapshot recording algorithms		R, U, A
CO-03	Introduce Distributed mutual exclusion algorithms and Deadlock detection in distributed systems		An
CO-04	To know about recovery and consensus algorithms.		E
CO-05	To analyze the current popular distributed systems such as peer-to-peer (P2P) systems will also be analyzed.		An

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO						
	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	M	S	M	M	M	L	M
CO-02	S	S	M	M	M	L	M

CO-03	S	S	M	M	M	L	M
CO-04	S	S	M	M	L	L	M
CO-05	S	L	M	M	L	L	M

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I INTRODUCTION

9

Introduction: Definition –Relation to computer system components –Motivation –Relation to parallel systems – Message-passing systems versus shared memory systems –Primitives for distributed communication –Synchronous versus asynchronous executions –Design issues and challenges. **A model of distributed computations:** A distributed program –A model of distributed executions –Models of communication networks –Global state – Cuts –Past and future cones of an event –Models of process communications. **Logical Time:** A framework for a system of logical clocks –Scalar time –Vector time – Physical clock synchronization: NTP.

UNIT II MESSAGE ORDERING & SNAPSHOTS

9

Message ordering and group communication: Message ordering paradigms –Asynchronous execution with synchronous communication –Synchronous program order on an asynchronous system –Group communication – Causal order (CO) - Total order. **Global state and snapshot recording algorithms:** Introduction –System model and definitions –Snapshot algorithms for FIFO channels

UNIT III DISTRIBUTED MUTEX & DEADLOCK

9

Distributed mutual exclusion algorithms: Introduction – Preliminaries – Lamport’s algorithm – Ricart-Agrawala algorithm – Maekawa’s algorithm – Suzuki-Kasami’s broadcast algorithm. **Deadlock detection in distributed systems:** Introduction – System model – Preliminaries – Models of deadlocks – Knapp’s classification – Algorithms for the single resource model, the AND model and the OR model.

UNIT IV RECOVERY & CONSENSUS

9

Checkpointing and rollback recovery: Introduction – Background and definitions – Issues in failure recovery – Checkpoint-based recovery – Log-based rollback recovery – Coordinated checkpointing algorithm – Algorithm for asynchronous checkpointing and recovery. **Consensus and agreement algorithms:** Problem definition – Overview of results – Agreement in a failure – free system – Agreement in synchronous systems with failures.

UNIT V P2P & DISTRIBUTED SHARED MEMORY

9

Peer-to-peer computing and overlay graphs: Introduction – Data indexing and overlays – Chord – Content addressable networks – Tapestry. **Distributed shared memory:** Abstraction and advantages – Memory consistency models –Shared memory Mutual Exclusion.

TOTAL: 45 HOURS

REFERENCES:

1. Kshemkalyani, Ajay D., and Mukesh Singhal. Distributed computing: principles, algorithms, and systems. Cambridge University Press, 2011.
2. George Coulouris, Jean Dollimore and Tim Kindberg, Distributed Systems Concepts and Design, Fifth Edition, Pearson Education, 2012.

3. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
4. Mukesh Singhal and Niranjana G. Shivaratri. Advanced concepts in operating systems. McGraw-Hill, Inc., 1994.
5. Tanenbaum A.S., Van Steen M., Distributed Systems: Principles and Paradigms, Pearson Education, 2007.
6. Liu M.L., Distributed Computing, Principles and Applications, Pearson Education, 2004.
7. Nancy A Lynch, Distributed Algorithms, Morgan Kaufman Publishers, USA, 2003.

CS35A2	DATA PREPARATION AND ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To prepare the data for analysis and develop meaningful Data Visualizations.
- To work with a variety of real-world data sets.
- To learn how to prepare data sets for analysis by cleaning and reformatting.
- To apply a variety of different data exploration techniques including summary statistics and visualization methods.

Subject Code: CS35A2		Subject Name: Data preparation and Analysis	
Course Outcome – Cos			Cognitive Skill
CO-01	Work in a business environment in which data preparation occurs.		R, U
CO-02	Prepare data marts for statistical analysis.		A
CO-03	Read data from databases and clean the data for statistical analysis.		An
CO-04	Develop strategies for dealing with imperfect real-world data.		E
CO-05	Understand ethics in the profession.		R, U

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	M	L	M	L	M	M
CO-02	M	L	M	S	M	S	L
CO-03	L	L	S	S	S	M	M
CO-04	S	L	S	M	M	S	S
CO-05	M	M	S	L	M	M	M

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I**9**

Introduction: Sources of data, process for making sense of data. Describing Data: Observations and variables, types of variables, central tendency, distribution of the data, confidence intervals, hypothesis tests.

UNIT II**9**

Preparing data tables: Cleaning the data, removing observations and variables, Removing Observations and Variables, Generating Consistent Scales Across Variables, New Frequency Distribution, Converting Text to Numbers, Converting Continuous Data to Categories, Combining Variables, Generating Groups, Preparing Unstructured Data.

UNIT III**9**

Exploratory Analysis, Descriptive and comparative statistics, clustering and association, hypothesis generation. Identifying and understanding groups: Learning Decision Trees from Data.

UNIT IV**9**

Visualization, Designing visualizations, time series, geolocated data, correlations and connections, hierarchies and networks, interactivity.

UNIT V**9**

Understanding relationships: Visualizing Relationships between Variables, Calculating Metrics About Relationships. Building models from data: Overview, Linear Regression, Logistic Regression, k-Nearest Neighbors, Classification and Regression Trees, Ethics in the profession: Cases in computing, statistics and communication.

TOTAL: 45 HOURS**REFERENCES**

1. Glenn J. Myatt, Wayne P. Johnson, "Making Sense of Data: A Practical Guide to Exploratory Data Analysis and Data Mining", 2nd Edition, Wiley, 2014.
2. Edward R. Tufte, "The Visual display of Quantitative Information", 2nd Edition, Graphics Press Cheshire, 2001.
3. Ben Fry, "Visualizing Data: Exploring and Explaining Data with the Processing Environment", O'Reilly Media Inc., First Edition, 2007.
4. Tamraparni Dasu, Theodore Johnson, "Exploratory Data Mining and Data Cleaning", John Wiley & Sons Inc., Wiley Series in Probability and Statistics, 2003.

CS35A3	DIGITAL IMAGE PROCESSING AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES

- Develop an overview of the field of image processing.
- Understand the fundamental algorithms and how to implement them
- Prepare to read the current image processing research literature
- Gain experience in applying image processing algorithms to real problems

Subject Code: CS35A3		Subject Name: Digital Image Processing and Applications	
Course Outcome – Cos			Cognitive Skill
CO-01	Understand the need for image transforms different types of image transforms and their properties.	R, U	
CO-02	Learn different techniques employed for the enhancement of images.	A	
CO-03	Understand Image segmentation and feature analysis	An	
CO-04	Evaluate the methodologies for image segmentation, restoration etc	U, E	
CO-05	Understand the need for image compression and to learn the spatial and frequency domain techniques of image compression.	U, A	

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	M	M	M	M	M	M	S
CO-02	M	M	M	S	S	M	S
CO-03	S	M	M	S	S	M	M
CO-04	S	S	M	S	S	M	S
CO-05	S	S	M	M	M	M	S

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I FUNDAMENTALS OF IMAGE PROCESSING

9

Introduction, Elements of visual perception, Steps in Image Processing Systems, Image Acquisition, Sampling and Quantization, Pixel Relationships, Colour Fundamentals and Models, File Formats. Introduction to the Mathematical tools.

UNIT II IMAGE ENHANCEMENT AND RESTORATION

9

Spatial Domain Gray Level Transformations Histogram Processing Spatial Filtering, Smoothing and Sharpening. Frequency Domain: Filtering in Frequency Domain, FT, FFT, DCT, Smoothing and Sharpening filter, Homomorphic Filtering, Noise models, Constrained and Unconstrained restoration models.

UNIT III IMAGE SEGMENTATION AND FEATURE ANALYSIS

9

Detection of Discontinuities, Edge Operators, Edge Linking and Boundary Detection, Thresholding, Region Based Segmentation, Motion Segmentation, Feature Analysis and Extraction.

UNIT IV MULTI RESOLUTION ANALYSIS AND COMPRESSIONS 9

Multi Resolution Analysis: Image Pyramids, Multi resolution expansion, Wavelet Transforms, Fast Wavelet transforms, Wavelet Packets. Image Compression: Fundamentals, Models, Elements of Information Theory, Error Free Compression, Lossy Compression, Compression Standards, JPEG/MPEG.

UNIT V APPLICATIONS OF IMAGE PROCESSING 9

Representation and Description, Image Recognition, Image Understanding, Image Classification, Video Motion Analysis, Image Fusion, Steganography, Colour Image Processing.

TOTAL: 45 HOURS

REFERENCES

1. R. C.Gonzalez, R.E.Woods, "Digital Image processing", Pearson edition, Inc3/e,2008.
2. Milan Sonka, Vaclav Hlavac and Roger Boyle, "Image Processing, Analysis and Machine Vision", Third Edition, Third Edition, Brooks Cole, 2008.
3. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice-Hall India, 2007.
4. Madhuri A. Joshi, 'Digital Image Processing: An Algorithmic Approach', Prentice- Hall India, 2006.
5. Rafael C.Gonzalez , Richard E.Woods and Steven L. Eddins, "Digital Image Processing Using MATLAB", First Edition, Pearson Education, 2004.

CS35A4	BIOINFORMATICS	L	T	P	C
		3	0	0	3

AIM

To gain knowledge about database different types of biological databases. Also learn the types of database search tools.

OBJECTIVES

- To gain knowledge about various biological databases that provide information about nucleic acids and protein.
- Introduction to Biological databases and database systems.
- To learn bio-informatics algorithms
- Overview about types and biological data and database search tools.

Subject Code: CS35A4		Subject Name: Bio-Informatics	
Course Outcome – Cos			Cognitive Skill
CO-01	To get introduced to the basic concepts of Bioinformatics and its significance in biological data analysis.		R, U
CO-02	Describe the history, scope and importance of DNA sequence and apply role of DNA in Bioinformatics.		A
CO-03	Explain about the characteristics and manage the different types of phylogenetics.		An
CO-04	Overview about protein classification		U

CO-05	Understand drug discovery methods	U, A
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R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO- A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	L	M	N	L	M	L	M
CO-02	L	L	L	M	L	L	L
CO-03	L	L	S	L	L	L	L
CO-04	M	M	S	L	M	M	M
CO-05	M	M	N	M	M	M	M

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I INTRODUCTION

9

What is Bio-Informatics, Overview- Major databases in Bio Informatics- Molecular biology – Central Dogma Data retrieval tools – gene structure - Prokaryotic and Eukaryotic Genomes – Sequence Assembly – Gene mapping – Physical maps – cloning — the genetic material — chemical bonds – molecular biology tools – genomic information content.

UNIT II DNA

9

DNA: working with single DNA sequence : removing vector sequences- verifying restriction maps – PCR design – GC content – counting words – internal repeats – protein coding regions – ORFing – Genomescan Protein: predicting properties – primary structure analysis – transmembrane segments – PROSITE patterns – interpreting scan prosite results- finding domains – CD server results – pfscan results. – Alignment of Pair of Sequences

UNIT III PHYLOGENETICS

9

Phylogenetics – phylogenetic trees –Parsimony – ancestral sequences – strategies for faster searches – consensus trees – tree confidence – comparison of phylogenetic methods – molecular phylogenie. Dot matrix – using scoring matrices – PAM matrices – BLOSUM. - Working with FASTA – Algorithm – output – E-values – Histogram. Working with BLAST – algorithm – output – services – gapped BLAST- PSIBLAST – comparison of FASTA and BLAST. - Multiple sequence alignment - Criteria for Multiple sequence alignment – applications – choosing the right sequences; FASTA, ClustalW, TCOffee methods

UNIT IV PROTEIN CLASSIFICATION

9

Interpreting multiple sequence alignment – getting in right format – converting formats – using Jalview – preparing for publication. - Protein Classification & Structure Prediction - Structure of amino acids – primary structure – secondary structure – folds and motifs – alpha and beta helix – structure based protein classification – protein structure Data bases – folding problem – PROPSearch – primary structure analysis and prediction – secondary structure analysis and prediction – motifs – profiles – patterns and fingerprints

UNIT V DRUG DISCOVERY**9**

Drug Discovery – components – process – Perspectives – Numeric considerations – Algorithms – Hardware – Issues – Protein structure – Abinitio Methods – Heuristic methods – Systems Biology – Tools – Collaboration and Communications – standards - Issues – Security – Intellectual property

TOTAL:45 HOURS**REFERENCES**

1. Arthur M. Lesk, “Introduction to Bioinformatics”, Second Edition, Oxford University Press, 2005.
2. T. K. Attwood, D. J. Parry-Smith, and S. Phukan, “Introduction to Bioinformatics”, Pearson Education, 1999.
3. Vittal R. Srinivas, “Bioinformatics – A Modern Approach”, Prentice-Hall of India Pvt. Ltd., 2005
4. S.C Rostogi , Mendiratta, P.Rasogi, “ BioInformatics: methods and applications”,second edition, PHI 2006.
5. Jean Mickel Clavere & Cadrienotredom “Bio Informatics– A beginners guide” Wiley DreamTech, 2003.
6. T.K. Attwood and D.J Perry Smith, “ Introduction to Bio Informatics”, Pearson Education, 1st Edition, 2001.

CS35A5	EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the fundamental concepts and framework of Embedded Systems
- To apply real time operating system in embedded system.

Subject Code: CS35A5		Subject Name: Embedded Systems	
Course Outcome – Cos			Cognitive Skill
CO-01	Understand the concept of embedded system, microcontroller, different components of microcontroller and their interactions.		R,U
CO-02	Get familiarized with programming environment to develop embedded solutions. Understand the key concepts of embedded systems such as I/O, timers, interrupts and interaction with peripheral devices.		R, U
CO-03	Program ARM microcontroller to perform various tasks		A
CO-04	Learn Real time operating system and scheduling.		A
CO-05	Apply scheduling in real time concepts.		A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO -A	PO -B	PO -C	P O- D	PO -E	PO -F	PO- G
CO-01	S	L	S	S	S	M	L
CO-02	L	N	M	L	N	N	S
CO-03	S	L	L	S	M	L	S
CO-04	N	S	M	L	S	S	S
CO-05	M	M	M	S	L	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS

9

Definition and Classification – Overview of Processors and hardware units in an embedded system – Software embedded into the system – Exemplary Embedded Systems – Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits

UNIT II DEVICES AND BUSES FOR DEVICES NETWORK

9

I/O Devices - Device I/O Types and Examples – Synchronous - Iso-synchronous and Asynchronous Communications from Serial Devices - Examples of Internal Serial-Communication Devices - UART and HDLC - Parallel Port Devices - Sophisticated interfacing features in Devices/Ports- Timer and Counting Devices - ‘12C’, ‘USB’, ‘CAN’ and advanced I/O Serial high speed buses- ISA, PCI, PCI-X, cPCI and advanced buses.

UNIT III - PROGRAMMING CONCEPTS AND EMBEDDED PROGRAMMING IN C, C++

9

Programming in assembly language (ALP) vs. High Level Language - C Program Elements, Macros and functions -Use of Pointers - NULL Pointers - Use of Function Calls – Multiple function calls in a Cyclic Order in the Main Function Pointers – Function Queues and Interrupt Service Routines Queues Pointers – Concepts of EMBEDDED PROGRAMMING in C++ - Objected Oriented Programming – Embedded Programming in C++, ‘C’ Program compilers – Cross compiler – Optimization of memory codes.

UNIT IV REAL TIME OPERATING SYSTEMS – PART - 1

9

REAL TIME OPERATING SYSTEMS : RTOS Task scheduling models - Handling of task scheduling and latency and deadlines as performance metrics – Co-operative Round Robin Scheduling – Cyclic Scheduling with Time Slicing (Rate Monotonics Co-operative Scheduling) – Preemptive Scheduling Model strategy by a Scheduler – Critical Section Service by a Preemptive Scheduler – Fixed (Static) Real time scheduling of tasks - INTER PROCESS COMMUNICATION AND SYNCHRONISATION – Shared data problem – Use of Semaphore(s) – Priority Inversion Problem and Deadlock Situations – Inter Process

Communications using Signals – Semaphore Flag or mutex as Resource key – Message Queues – Mailboxes – Pipes – Virtual (Logical) Sockets – Remote Procedure Calls (RPCs).

UNIT V **REAL TIME OPERATING SYSTEMS – PART - 2** **9**

Study of Micro C/OS-II or Vx Works or Any other popular RTOS – RTOS System Level Functions – Task Service Functions – Time Delay Functions – Memory Allocation Related Functions – Semaphore Related Functions – Mailbox Related Functions – Queue Related Functions – Case Studies of Programming with RTOS – Multiple Tasks and their functions – Creating a list of tasks – Functions and IPCs – Exemplary Coding Steps.

REFERENCES

1. Rajkamal, Embedded Systems Architecture, Programming and Design, TATA McGrawHill, First reprint Oct. 2003.
2. Steve Heath, Embedded Systems Design, Second Edition-2003, Newness.
3. Wayne Wolf, Computers as Components; Principles of Embedded Computing System Design – Harcourt India, Morgan Kaufman Publishers, First Indian Reprint 2001.
4. Frank Vahid and Tony Givargis, Embedded Systems Design – A unified Hardware / Software Introduction, John Wiley, 2002.

Elective – II

CS35A6	MACHINE LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the need for machine learning for various problem solving
- To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
- To understand the latest trends in machine learning
- To design appropriate machine learning algorithms for problem solving

Subject Code: CS35A6		Subject Name: Machine Learning	
Course Outcome – Cos			Cognitive Skill
CO-01	Learning problems, perspectives and Issues		R, U
CO-02	Ability to understand neural networks and genetic algorithm models of evaluation.		A
CO-03	Understand Bayesian learning		U, An
CO-04	Evaluate and define instant based learning		E
CO-05	Study the rules and regulations of advanced learning		A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	L	L	M	L	M	M
CO-02	M	M	S	M	M	M	L
CO-03	M	M	M	M	M	S	S
CO-04	S	S	S	M	M	S	S
CO-05	S	S	M	M	S	S	S

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I INTRODUCTION

9

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

UNIT II NEURAL NETWORKS AND GENETIC ALGORITHMS

9

Neural Network Representation – Problems – Perceptron – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

UNIT III BAYESIAN AND COMPUTATIONAL LEARNING

9

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

UNIT IV INSTANT BASED LEARNING

9

K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning.

UNIT V ADVANCED LEARNING

9

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning.

TOTAL :45 HOURS

REFERENCES

1. Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2. Ethem Alpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
3. Stephen Marsland, —Machine Learning: An Algorithmic Perspectivel, CRC Press, 2009.

CS35A7	DATA STORAGE TECHNOLOGIES AND NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To gain knowledge and understand the design of a Data Centre.
- To understand the best practice of design in the Data Centre.
- To learn the options in the running of an efficient Data Centre.
- To understand the value of data to a business, Information Lifecycle.
- To understand the challenges in data storage and data management.
- To learn solutions available for data storage

Subject Code: CS35A7		Subject Name: Data Storage Technologies and Networks	
Course Outcome – Cos			Cognitive Skill
CO-01	To explain the design of a data center and storage requirements		R,A
CO-02	To discuss the various types of storage and their properties		U
CO-03	To explain physical and virtualization of storage		R, U
CO-04	To explain the backup, archiving with regard to recovery and business continuity		U, E
CO-05	To explain the design of a data center and storage requirements		A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO						
	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	M	M	S	M	S	M	S
CO-02	M	M	N	S	L	M	M
CO-03	S	L	M	L	M	L	M
CO-04	M	S	M	M	M	M	S
CO-05	S	S	M	S	S	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I DATA CENTRE

9

DATA CENTRE: Introduction, Site Selection and Environmental Considerations, Hierarchical or Layered Architecture, Architect Roles, Goals and Skills, Architecture Precursors

UNIT II DATA CENTRE DESIGN ARCHITECTURE

9

Data Centre Design: Architecture Design and Standards Recommendations, Raised Access Floor and Design Best Practices, connecting the infrastructure with copper and fiber. IT Hardware, Cooling System Options and Environmental Control, Electrical Power Systems, Room Layout, Fire Protection and Security Systems, Building Automation and Energy Management Systems, Commissioning and Handover

UNIT III STORAGE MANAGEMENT

9

STORAGE MANAGEMENT: Introduction to Storage Technology, Storage Systems Architecture, Physical and logical components of a connectivity environment, Major physical components of a disk drive and their functions, Concept of RAID and its components, Different RAID levels and their suitability for different application environments: RAID 0, RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6, Integrated and Modular storage systems, high-level architecture and working of an intelligent storage systems

UNIT IV NETWORKED STORAGE

9

NETWORKED STORAGE: Evolution of networked storage, Architecture, components, and topologies of FC-SAN, NAS, and IP-SAN, Benefits of the different networked storage options, Need for long-term archiving solutions and describe how CAS fulfill the need, Appropriateness of the different networked storage options for different application environments

UNIT V

SECURING STORAGE AND STORAGE VIRTUALIZATION: Information Security, Critical security attributes for information systems, Storage security domains, Analyze the common threats in, each domain, Storage Virtualization: Forms, Configurations and Challenges, Types of Storage Virtualization: Block-level and File-Level.

TOTAL: 45 HOURS

REFERENCES

1. Mauricio Arregoces, Data Center Fundamentals, Cisco Press; 1st edition, 2003.
2. Robert Spalding, Storage Networks: The Complete Reference, Tata McGraw Hill, Osborne, 2003.
3. Marc Farley, Building Storage Networks, Tata McGraw Hill, Osborne. 2001.
4. Meeta Gupta, Storage Area Network Fundamentals, Pearson Education Limited, 2002
5. G. Somasundaram, Alok Shrivastava, Information Storage and Management, EMC Education Series, Wiley, Publishing Inc., 2011.
6. Gustavo Santana, Data Center Virtualization Fundamentals: Understanding Techniques and Designs for Highly Efficient Data Centers with Cisco Nexus, UCS, MDS, and Beyond, Cisco Press; 1 edition, 2013.

CS35A8	DATA MINING TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To study the architecture and functionalities of Data mining systems.
- To do the detailed study of data preprocessing and mining association rules.
- To study in detail about the predictive modeling

- To do the detailed study of data warehousing approaches.
- To study the applications of data mining in detail

Subject Code: CS35A8		Subject Name: Data Mining Techniques
Course Outcome – Cos		Cognitive Skill
CO-01	Understand the evolution of decision support systems and data warehousing.	R,U
CO-02	Ability to understand the architecture of data warehousing and apply in the field of business.	A
CO-03	Understand the concepts of data mining	U
CO-04	Overview of classification and clustering and learn how to make analysis.	U, An
CO-05	Predictive modelling of Big data analysis.	A, An

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	M	S	N	M	S	M	S
CO-02	M	M	N	S	L	M	M
CO-03	S	M	N	S	M	S	M
CO-04	S	S	N	S	S	S	S
CO-05	M	S	N	S	M	M	S

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I INTRODUCTION TO DATA WAREHOUSING

9

Evolution of Decision Support Systems- Data warehousing Components – Building a Data warehouse, Data Warehouse and DBMS, Data marts, Metadata, Multidimensional data model, OLAP vs OLTP, OLAP operations, Data cubes, Schemas for Multidimensional Database: Stars, Snowflakes and Fact constellations

UNIT II DATA WAREHOUSE PROCESS AND ARCHITECTURE

9

Types of OLAP servers, 3–Tier data warehouse architecture, distributed and virtual data warehouses. Data warehouse implementation, tuning and testing of data warehouse. Data Staging (ETL) Design and Development, data warehouse visualization, Data Warehouse Deployment, Maintenance, Growth, Business Intelligence Overview- Data Warehousing and Business Intelligence Trends - Business Applications- tools-SAS

UNIT III INTRODUCTION TO DATA MINING

9

Data mining-KDD versus data mining, Stages of the Data Mining Process-task primitives, Data Mining Techniques -Data mining knowledge representation – Data mining query languages, Integration of a Data Mining System with a Data Warehouse – Issues, Data preprocessing – Data cleaning, Data transformation, Feature selection, Dimensionality reduction, Discretization and generating concept hierarchies-Mining frequent patterns- association-correlation

UNIT IV CLASSIFICATION AND CLUSTERING

9

Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Clustering techniques – , Partitioning methods- k-means- Hierarchical Methods – distance based agglomerative and divisible clustering, Density-Based Methods – expectation maximization -Grid Based Methods – Model-Based Clustering Methods – Constraint – Based Cluster Analysis – Outlier Analysis

UNIT V PREDICTIVE MODELING OF BIG DATA AND TRENDS IN DATA MINING

9

Statistics and Data Analysis – EDA – Small and Big Data –Logistic Regression Model - Ordinary Regression Model-Mining complex data objects – Spatial databases – Temporal databases – Multimedia databases – Time series and sequence data – Text mining – Web mining – Applications in Data mining

TOTAL: 45 HOURS

REFERENCES:

1. Jiawei Han, Micheline Kamber, “Data Mining: Concepts and Techniques”, Morgan Kaufmann, Third edition, 2011.
2. Alex Berson, Stephen J. Smith, “Data Warehousing, Data Mining & OLAP”, Tata McGraw Hill, Tenth Reprint, 2007.
3. G. K. Gupta, “Introduction to Data Min Data Mining with Case Studies”, Eastern Economy Edition, Prentice Hall of India, Third Edition, 2014.
4. Ian.H.Witten, Eibe Frank and Mark.A.Hall, “Data Mining: Practical Machine Learning Tools and Techniques”, Morgan Kaufmann, Third edition, 2011.
5. Bruce Ratner, “Statistical and Machine - Learning Data Mining: Techniques for Better Predictive Modeling and Analysis of Big Data”, CRC Press, Second Edition, 2012.
6. Mehmed Kantardzic, “Data mining: Concepts, Models, Methods, and Algorithms”, Wiley-Blackwell, Second Edition, 2011.
7. Ian Witten, Eibe Frank, “Data Mining: Practical Machine Learning Tools and Techniques”, Third Edition, Morgan Kaufmann, 2011.
8. George M Marakas, “Modern Data Warehousing, Mining and Visualization: Core Concepts”, Prentice Hall, 2002.

CS35A9	SOFTWARE QUALITY ASSURANCE	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the different software engineering concepts with the tools for quality assurance.
- To learn software process and implantation.

Subject Code: CS35A9		Subject Name: Software Quality Assurance	
Course Outcome – Cos		Cognitive Skill	
CO-01	Understand the concepts of quality control.	R,U	
CO-02	Ability to study software engineering concepts	U	
CO-03	Understand and analyze quality assurance models	An	
CO-04	Learn software process and implementation	U, A	
CO-05	Learn industrial trends	R, U	

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	L	L	M	L	M	L
CO-02	L	M	S	S	S	S	S
CO-03	M	L	M	S	S	L	S
CO-04	M	M	S	S	S	M	N
CO-05	S	S	S	S	S	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I CONCEPTS

9

Concepts of Quality Control, Quality Assurance, Quality Management - Total Quality Management; Cost of Quality; QC tools - 7 QC Tools and Modern Tools; Other related topics - Business Process Re-engineering –Zero Defect, Six Sigma, Quality Function Deployment, Benchmarking, Statistical process control.

UNIT II SOFTWARE ENGINEERING CONCEPTS**9**

Software Engineering Principles, Software Project Management, Software Process, Project and Product Metrics, Risk Management, Software Quality Assurance; Statistical Quality Assurance - Software Reliability, Muse Model; Software Configuration Management; Software Testing; CASE (Computer Aided Software Engineering).

UNIT III QUALITY ASSURANCE MODELS**9**

Models for Quality Assurance-ISO-9000 - Series, CMM, SPICE, Malcolm Baldrige Award.

UNIT IV SOFTWARE QUALITY ASSURANCE RELATED TOPICS**9**

Software Process - Definition and implementation; internal Auditing and Assessments; Software testing -Concepts, Tools, Reviews, Inspections & Walkthroughs; P-CMM.

UNIT V INDUSTRIAL TRENDS**9**

PSP and TSP, CMMI, OO Methodology, Clean-room software engineering, Defect injection and prevention.

TOTAL: 45 HOURS**REFERENCES**

1. Watts Humphery, "Managing Software Process ", Addison - Wesley, 1998.
2. Philip B Crosby, " Quality is Free: The Art of Making Quality Certain ", Mass Market, 1992.
3. Roger Pressman, "Software Engineering ", Sixth Edition, McGraw Hill, 2005.

CS35B1	PARALLEL ALGORITHMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the basic concepts of parallel algorithms like sorting, searching and also for mapping data to processors.

Subject Code: CS35B1		Subject Name: Parallel Algorithms	
Course Outcome – Cos		Cognitive Skill	
CO-01	Understand the basics parallel reduction and ranking	R, U	
CO-02	Learn various models	U	
CO-03	Apply sorting techniques	A	
CO-04	Evaluate and define searching algorithms	E	
CO-05	Learn how to map data to processor	A	

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO- A	PO- B	PO- C	PO- D	PO- E	PO- F	PO- G
CO-01	S	L	L	M	L	M	L
CO-02	L	M	S	S	S	S	S
CO-03	M	L	M	S	S	L	S
CO-04	S	S	S	S	L	M	N
CO-05	S	S	S	L	S	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I INTRODUCTION

9

PRAM Model – PRAM Algorithms – Parallel Reduction – Prefix Sums – List Ranking – Preorder Tree Traversal – Merging Two Sorted Lists – Graph Coloring – Reducing Number of Processors – NC Class.

UNIT II MIMD

9

Classifying MIMD Algorithms – Hypercube SIMD Model – Shuffle Exchange SIMD Model – 2D Mesh SIMD Model – UMA Multiprocessor Model – Broadcast – Prefix Sums.

UNIT III SORTING

9

Enumeration Sort – Lower Bound on Parallel Sorting – Odd-Even Transposition Sort – Bitonic Merge – Parallel Quick Sort – Complexity of Parallel Search – Searching on Multiprocessors.

UNIT IV SEARCHING

9

P-Depth Search – Breadth Depth Search – Breadth First Search – Connected Components – All pair Shortest Path – Single Source Shortest Path – Minimum Cost Spanning Tree.

UNIT V ALGORITHMS

9

Matrix Multiplication on 2-D Mesh, Hypercube and Shuffle Exchange SIMD Models – Algorithms for Multiprocessors – Algorithms for Multicomputers – Mapping Data to Processors.

TOTAL: 45 HOURS

REFERENCES

1. Michael J. Quinn, Parallel Computing : Theory & Practice, Tata McGraw Hill Edition, 2003.
2. Ananth Grame, George Karpis, Vipin Kumar and Anshul Gupta, Introduction to Parallel Computing, 2nd Edition, Addison Wesley, 2003.

ELECTIVE - III

CS35B2	DATA VISUALIZATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand how accurately represent voluminous complex data set in web and from other data sources.
- To understand the methodologies used to visualize large data sets.
- To understand the process involved in data visualization and security aspects involved in data visualization.

Subject Code: CS35B2		Subject Name: Data Visualization	
Course Outcome – Cos			Cognitive Skill
CO-01	Understand the basics of data visualization and representation.	U	
CO-02	Understand various methodologies present in data visualization.	U	
CO-03	Discuss the process involved in data visualization.	U	
CO-04	Design and use various methods in interactive data visualization.	A	
CO-05	Design and use various security methods in visualization.	A	

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	M	S	N	M	S	M	S
CO-02	M	M	N	S	L	M	M
CO-03	L	L	S	L	M	L	M
CO-04	S	S	S	M	S	S	S
CO-05	S	S	S	S	M	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I INTRODUCTION

9

Context of data visualization – Definition, Methodology, Visualization design objectives. Key Factors – Purpose, visualization function and tone, visualization design options – Data

representation, Data Presentation, Seven stages of data visualization, widgets, data visualization tools.

UNIT II VISUALIZING DATA METHODS 9

Mapping - Time series - Connections and correlations - Scatterplot maps - Trees, Hierarchies and Recursion - Networks and Graphs, Info graphics.

UNIT III VISUALIZING DATA PROCESS 9

Acquiring data, - Where to Find Data, Tools for Acquiring Data from the Internet, Locating Files for Use with Processing, Loading Text Data, Dealing with Files and Folders, Listing Files in a Folder, Asynchronous Image Downloads, Advanced Web Techniques, Using a Database, Dealing with a Large Number of Files. Parsing data - Levels of Effort, Tools for Gathering Clues, Text Is Best, Text Markup Languages, Regular Expressions (regexps), Grammars and BNF Notation, Compressed Data, Vectors and Geometry, Binary Data Formats, Advanced Detective Work.

UNIT IV INTERACTIVE DATA VISUALIZATION 9

Drawing with data – Scales – Axes – Updates, Transition and Motion – Interactivity - Layouts – Geomapping – Exporting, Framework – T3, .js, tablo.

UNIT V SECURITY DATA VISUALIZATION 9

Port scan visualization - Vulnerability assessment and exploitation - Firewall log visualization - Intrusion detection log visualization -Attacking and defending visualization systems - Creating security visualization system.

TOTAL: 45 HOURS

REFERENCES:

1. Scott Murray, “Interactive data visualization for the web”, O’Reilly Media, Inc., 2013.
2. Ben Fry, “Visualizing Data”, O’Reilly Media, Inc., 2007.
3. Greg Conti, “Security Data Visualization: Graphical Techniques for Network Analysis”, No Starch Press Inc, 2007.

CS35B3	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To know the fundamental concepts of big data and analytics.
- To explore tools and practices for working with big data
- To learn about stream computing.
- To know about the research that requires the integration of large amounts of data.

Subject Code: CS35B3		Subject Name: Big Data Analytics	
Course Outcome – Cos			Cognitive Skill
CO-01	Work with big data tools and its analysis techniques.		A
CO-02	Analyze data by utilizing clustering and classification algorithms.		An

CO-03	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	U,A
CO-04	Perform analytics on data streams.	A
CO-05	Learn NoSQL databases and management.	U

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO- A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	M	S	S	M	S	M	S
CO-02	M	M	S	S	L	M	M
CO-03	L	L	S	L	M	L	M
CO-04	M	S	S	M	S	S	S
CO-05	M	S	S	S	M	M	S

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I INTRODUCTION TO BIG DATA

9

Evolution of Big data - Best Practices for Big data Analytics - Big data characteristics - Validating - The Promotion of the Value of Big Data - Big Data Use Cases- Characteristics of Big Data Applications - Perception and Quantification of Value -Understanding Big Data Storage - A General Overview of High- Performance Architecture - HDFS - MapReduce and YARN - Map Reduce Programming Model

UNIT II CLUSTERING AND CLASSIFICATION

9

Advanced Analytical Theory and Methods: Overview of Clustering - K-means - Use Cases - Overview of the Method - Determining the Number of Clusters - Diagnostics - Reasons to Choose and Cautions .- Classification: Decision Trees - Overview of a Decision Tree - The General Algorithm - Decision Tree Algorithms - Evaluating a Decision Tree - Decision Trees in R - Naïve Bayes - Bayes' Theorem - Naïve Bayes Classifier.

UNIT III ASSOCIATION AND RECOMMENDATION SYSTEM

9

Advanced Analytical Theory and Methods: Association Rules - Overview - Apriori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Finding Association& finding similarity - Recommendation System: Collaborative Recommendation- Content Based Recommendation - Knowledge Based Recommendation- Hybrid Recommendation Approaches.

UNIT IV STREAM MEMORY

9

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. Using Graph Analytics for Big Data: Graph Analytics

UNIT V NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION 9

NoSQL Databases : Schema-less Models: Increasing Flexibility for Data Manipulation- Key Value Stores- Document Stores - Tabular Stores - Object Data Stores - Graph Databases Hive - Sharding — Hbase – Analyzing big data with twitter - Big data for E-Commerce Big data for blogs - Review of Basic Data Analytic Methods using R.

TOTAL: 45 HOURS

REFERENCES:

1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/Elsevier Publishers, 2013.
3. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
4. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
5. Dietmar Jannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, 2010.
6. Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2015.
7. Jimmy Lin and Chris Dyer, "Data-Intensive Text Processing with MapReduce", Synthesis Lectures on Human Language Technologies, Vol. 3, No. 1, Pages 1-177, Morgan Claypool publishers, 2010.

CS35B4	DATA WAREHOUSING AND DATA MINING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand data warehouse concepts, architecture, business analysis and tools.
- To understand data pre-processing and data visualization techniques.
- To study algorithms for finding hidden and interesting patterns in data.
- To understand and apply various classification and clustering techniques using tools.

Subject Code: CS35B4		Subject Name: Data Warehouse and Data Mining	
Course Outcome – Cos			Cognitive Skill
CO-01	Understand data warehouse system and perform business analysis with OLAP tools.		U, A
CO-02	Understand data mining systems and data visualization concepts.		U
CO-03	Apply frequent pattern analysis techniques for data mining.		A

CO-04	Apply appropriate classification and clustering techniques for data analysis.	A
CO-05	Understand and work with WEKA tool.	U,A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO- A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	M	S	S	M	S	M	S
CO-02	M	M	S	S	L	M	M
CO-03	S	M	S	S	M	S	M
CO-04	S	S	S	S	S	S	S
CO-05	M	S	S	S	M	M	S

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING (OLAP) 9

Basic Concepts – Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.

UNIT II DATA MINING – INTRODUCTION 9

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

UNIT III DATA MINING – FREQUENT PATTERN ANALYSIS 9

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns

UNIT IV CLASSIFICATION AND CLUSTERING 9

Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines — Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy. Clustering Techniques – Cluster analysis-Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.

UNIT V WEKA TOOL**9**

Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database – Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.

TOTAL: 45 HOURS**REFERENCES:**

1. Jiawei Han and Micheline Kamber, —Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.
2. Alex Berson and Stephen J.Smith, —Data Warehousing, Data Mining & OLAP, Tata McGraw – Hill Edition, 35th Reprint 2016.
3. K.P. Soman, Shyam Diwakar and V. Ajay, —Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006.
4. Ian H.Witten and Eibe Frank, —Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition.

CS35B5	SOCIAL NETWORK ANALYSIS	L	T	P	C
		3	0	0	3

AIM:

To provide a strong foundation in social network analysis.

OBJECTIVES:

- To gain knowledge about the current web development and emergence of social web.
- To study about the modeling, aggregating and knowledge representation of semantic web.
- To appreciate the use of machine learning approaches for web content mining.
- To learn about the extraction and mining tools for social networks.
- To gain knowledge on web personalization and web visualization of social networks.

Subject Code: CS35B5		Subject Name: Social Network Analysis	
Course Outcome – Cos		Cognitive Skill	
CO-01	Apply knowledge of current web development in the era of social web.	A	
CO-02	Model, aggregate and represent knowledge for semantic web.	U	
CO-03	Use machine learning approaches for web content mining.	U	
CO-04	Design extraction and mining tools for social networks.	An	
CO-05	Develop personalized web sites and visualization for social networks.	A	

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO- A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	S	S	S	M	S	S	S
CO-02	M	M	S	S	L	M	M
CO-03	S	L	S	S	M	S	L
CO-04	S	S	S	S	S	S	S
CO-05	M	S	S	S	M	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I CLUSTERING AND CLASSIFICATION

9

Supervised Learning – Decision tree - Naïve Bayesian Text Classification - Support Vector Machines - Ensemble of Classifiers – Unsupervised Learning – K-means Clustering – Hierarchical Clustering – Partially Supervised Learning – Markov Models – Probability-Based Clustering – Vector Space Model

UNIT II SOCIAL MEDIA MINING

9

Data Mining Essentials – Data Mining Algorithms - Web Content Mining – Latent semantic Indexing – Automatic Topic Extraction – Opinion Mining and Sentiment Analysis – Document Sentiment Classification

UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS

9

Extracting evolution of Web Community from a Series of Web Archive – Detecting Communities in Social Networks – Definition of Community – Evaluating Communities – Methods for Community Detection & Mining – Applications of Community Mining Algorithms – Tools for Detecting Communities – Social Network Infrastructure and Communities – Decentralized Online Social Networks – Multi-Relational Characterization of Dynamic Social Network Communities

UNIT IV HUMAN BEHAVIOR ANALYSIS AND PRIVACY ISSUES

9

Understanding and Predicting Human Behavior for Social Communities – User Data Management, Inference and Distribution – Enabling New Human Experiences – Reality Mining – Context-Awareness – Privacy in Online Social Networks – Trust in Online Environment – Trust Models Based on Subjective Logic – Trust Network Analysis – Trust Transitivity Analysis – Combining Trust and Reputation – Trust Derivation Based on Trust Comparisons – Attack Spectrum and Countermeasures

UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS

9

Graph Theory – Centrality – Clustering – Node-Edge Diagrams – Matrix representation – Visualizing Online Social Networks – Visualizing Social Networks with Matrix-Based Representations – Node-Link Diagrams – Hybrid Representations – Applications – Covert Networks – Community Welfare – Collaboration Networks – Co-Citation Networks –

Recommendation in Social Media: Challenges – Classical Recommendation Algorithms – Recommendation Using Social Context – Evaluating Recommendations

TOTAL : 45 HOURS

REFERENCES:

1. Peter Mika, “Social networks and the Semantic Web”, Springer, 2007.
2. Borko Furht, “Handbook of Social Network Technologies and Applications”, Springer, 2010.
3. Bing Liu, “Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data (Data-Centric Systems and Applications)”, Springer; Second Edition, 2011.
4. Reza Zafarani, Mohammad Ali Abbasi, Huan Liu, ”Social Media Mining”, Cambridge University Press, 2014.
5. Guandong Xu, Yanchun Zhang and Lin Li, “Web Mining and Social Networking Techniques and applications”, Springer, 2011.
6. Dion Goh and Schubert Foo, “Social information retrieval systems: emerging technologies and Applications for searching the Web effectively”, Idea Group, 2007.

CS35B6	VIRTUALIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concepts of virtualization and virtual machines.
- To understand the implementation of process and system virtual machines.
- To explore the aspects of high level language virtual machines.
- To gain expertise in server, network and storage virtualization.
- To understand and deploy practical virtualization solutions and enterprise solutions.

Subject Code: CS35B6		Subject Name: Virtualization Techniques
Course Outcome – Cos		Cognitive Skill
CO-01	Classify Virtual Machines.	U
CO-02	Deploy legacy OS on virtual machines.	C
CO-03	Analyze the intricacies of server, storage and network virtualizations.	An
CO-04	Design and develop applications on virtual machine platforms.	A
CO-05	Suggest appropriate high level language virtual machine for the problem in hand.	U

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G

CO-01	M	M	M	M	S	S	S
CO-02	S	M	M	S	L	S	S
CO-03	S	L	M	S	M	S	L
CO-04	S	S	M	S	S	S	S
CO-05	M	L	M	M	L	M	M

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I OVERVIEW OF VIRTUALIZATION 9

System Architectures - Virtual Machine Basics - Process vs System Virtual Machines - Taxonomy. Emulation: Basic Interpretation - Threaded Interpretation - Precoded and Direct Threaded Interpretation - Binary Translation. System Virtual Machines - Key Concepts - Resource utilization basics.

UNIT II PROCESS VIRTUAL MACHINES 9

Implementation – Compatibility – Levels – Framework – State Mapping – Register – Memory Address Space – Memory Architecture Emulation – Memory Protection – Instruction Emulation – Performance Tradeoff - Staged Emulation – Exception Emulation – Exception Detection – Interrupt Handling – Operating Systems Emulation – Same OS Emulation – Different OS Emulation – System Environment.

UNIT III HIGH LEVEL LANGUAGE VIRTUAL MACHINES AND SERVER VIRTUALIZATION 9

HLL Virtual Machines: Pascal P-Code – Object Oriented HLLVMs - Java VM architecture - Java Native Interface - Common Language Infrastructure. Server virtualization: Partitioning techniques - virtual hardware - uses of virtual servers - server virtualization platforms

UNIT IV NETWORK AND STORAGE VIRTUALIZATION 9

Design of Scalable Enterprise Networks – Layer2 Virtualization – VLAN - VFI - Layer 3 Virtualization – VRF - Virtual Firewall Contexts - Network Device Virtualization - Data- Path Virtualization - Routing Protocols. Hardware Devices – SAN backup and recovery techniques – RAID – Classical Storage Model – SNIA Shared Storage Model – Virtual Storage: File System Level and Block Level

UNIT V APPLYING VIRTUALIZATION 9

Practical Virtualization Solutions: Comparison of Virtualization Technologies: Guest OS/ Host OS – Hypervisor – Emulation – Kernel Level – Shared Kernel, Enterprise Solutions: VMWare Server – VMWareESXi – Citrix Xen Server – Microsoft Virtual PC – Microsoft Hyper-V – Virtual Box, Server Virtualization: Configuring Servers with Virtualization – Adjusting and Tuning Virtual servers – VM Backup – VM Migration, Desktop Virtualization: Terminal services – Hosted Desktop – Web-based Solutions – Localized Virtual Desktops, Network and Storage Virtualization: Virtual Private Networks – Virtual LAN – SAN and VSAN – NAS

TOTAL: 45 HOURS

REFERENCES:

1. James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes”, Elsevier/Morgan Kaufmann, 2005.

2. David Marshall, Wade A. Reynolds, “Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center”, Auerbach Publications, 2006.
3. Kumar Reddy, Victor Moreno, “Network virtualization”, Cisco Press, July, 2006.
4. Chris Wolf, Erick M. Halter, “Virtualization: From the Desktop to the Enterprise”, A Press 2005.
5. Kenneth Hess, Amy Newman, “Practical Virtualization Solutions: Virtualization from the Trenches”, Prentice Hall, 2010.

ELECTIVE - IV

CS35B7	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamentals of Internet of Things.
- To learn about the basics of IOT protocols.
- To build a small low cost embedded system using Raspberry Pi.
- To apply the concept of Internet of Things in the real world scenario.

Subject Code: CS35B7		Subject Name: Internet of things	
Course Outcome – Cos		Cognitive Skill	
CO-01	Analyze various protocols for IoT	An	
CO-02	Develop web services to access/control IoT devices.	A	
CO-03	Design a portable IoT using Raspberry Pi	U	
CO-04	Deploy an IoT application and connect to the cloud.	A	
CO-05	Analyze applications of IoT in real time scenario	An	

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO- A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	N	M	S	L	M	M	L
CO-02	N	S	L	L	M	S	S
CO-03	L	L	S	M	L	L	M
CO-04	L	L	L	S	M	M	L
CO-05	L	S	L	L	M	S	L

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I INTRODUCTION TO IoT

9

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology

UNIT II IoT ARCHITECTURE

9

M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture

UNIT III IoT PROTOCOLS

9

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus–Zigbee Architecture – Network layer – 6LowPAN - CoAP - Security

UNIT IV BUILDING IoT WITH RASPBERRY PI & ARDUINO

9

Building IOT with RASPBERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.

UNIT V CASE STUDIES AND REAL-WORLD APPLICATIONS

Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs – Cloud for IoT - Amazon Web Services for IoT.

TOTAL: 45 HOURS

REFERENCES:

1. Arshdeep Bahga, Vijay Madisetti, Internet of Things – A hands-on approach, Universities Press, 2015.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), Architecting the Internet of Things, Springer, 2011.
3. Honbo Zhou, The Internet of Things in the Cloud: A Middleware Perspective, CRC Press, 2012.
4. Jan Holler, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
5. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things – Key applications and Protocols, Wiley, 2012.

CS35B8	WEB CONTENT DESIGN AND MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the design principles and interaction.
- To explore the detailed design practices, standards.
- To gain an insight into Content Management System for content design.
- To use any Content Management System tool for better content management.
- To get familiarized with Web Analytics for better management.

Subject Code: CS35B8		Subject Name: Web Content Design and Management			
Course Outcome – Cos					Cognitive Skill
CO-01	Design web pages that follow standards and are usable.				C
CO-02	Design web sites that are appealing.				C
CO-03	To be able to use Content management System for designing web Content.				U
CO-04	To take advantage of Content Management System tools for managing content for large web sites.				A
CO-05	To be able to use analytics tools for better management.				A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	M	M	M	M	M	L
CO-02	M	S	M	M	M	L	N
CO-03	L	M	M	M	M	M	L
CO-04	S	L	M	M	M	M	M
CO-05	M	S	M	M	M	M	L

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I PRINCIPLES OF WEB DESIGN

9

User Centered Design, Web Medium, Information Architectures, Site Types and Architectures, Page Structure, Site Maps, Navigation, Search, Web Design Process, Designing for Multiple Screen Resolutions, Creating A Unified Site Design, Evaluating Web Sites.

UNIT II ELEMENTS OF PAGE DESIGN**9**

Elements Of Page Design, Adding Styles With CSS, Pages And Layout, Typography, Color, Images, GUI Widgets and Forms, Responsive Web Designs, User Input Forms, Working With Data Tables, Web Standards And Styles.

UNIT III WEB CONTENT DESIGN**9**

Features – Automated Templates – Template Processor –Front Controller Pattern – Content Modeling – Content Aggregation – Plug-Ins – Search Engine Optimization – Recommended Usage of Tools – WORDPRESS

UNIT IV WEB CONTENT MANAGEMENT**9**

Work Flow Management – Document Management – Collaboration – Versioning – Recommended Usage of Tools – WORDPRESS

UNIT V WEB ANALYTICS**9**

Web Analytics Process – Data Collection – Qualitative Analysis – Log File Analysis – Page Tagging – Hybrid Methods – Click Analytics – Onsite and Offsite Analytics – Web Analytics Methods

TOTAL: 45 HOURS**REFERENCES:**

1. Patrich J. Lynch, Sarah Horton, “Web Style Guide-Foundations of User Experience Design”, Yale University Press, 4th Edition, 2016.
2. Thomas A. Powell, “The Complete Reference– Web Design”, Tata McGraw Hill, Second Edition, 2003.
3. Joel Sklar, “Principles of Web Design, Cengage Learning”, Web Warrior Series, 6th Edition, 2015.
4. Deane Barker, “Web Content management-Systems, Features and Best Practices”, O’reilly Media, 1st Edition, 2016.
5. Brian Clifton, “Advanced web Metrics with Google Analytics”, Third Edition, Sybex Publishers, 2012.
6. Avinash Kaushik, “Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity”, 1st edition, Sybex publishers, 2009.

CS35B9	DATABASE ADMINISTRATION AND TUNING	L	T	P	C
		3	0	0	3

AIM:

To understand the need for database administration and tuning.

OBJECTIVES:

- To understand the tasks in database administration.
- To learn the methods to secure the database and to recover from failures.
- To understand the fundamentals of database tuning.
- To apply indexing techniques and query optimization for database tuning.
- To understand and measure performance monitors to troubleshoot the database system.

Subject Code:CS35B9		Subject Name: Database Administration and Tuning	
Course Outcome – Cos		Cognitive Skill	
CO-01	Describe the principle functions in database administration and security	U	
CO-02	Discuss the need for performance tuning in databases	U	
CO-03	Write optimized code for accessing multiple databases	U	
CO-04	Reconstruct indexes and optimize queries for better database performance.	A	
CO-05	Carry out troubleshooting in database systems	A	

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	M	M	M	M	L	L
CO-02	S	M	M	M	M	L	L
CO-03	L	M	M	M	L	M	M
CO-04	M	M	M	M	L	M	S
CO-05	S	M	S	M	L	M	M

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I INTRODUCTION TO DATABASE ADMINISTRATION

10

Database Administration - DBA Tasks- Database Design - Performance Monitoring and Tuning – Availability - Database Security and Authorization - Backup and Recovery - Data Integrity - DBMS Release Migration - Types of DBAs - Creating the Database Environment - Choosing a DBMS - DBMS Architectures - DBMS Clustering - DBMS Proliferation - Hardware Issues - Installing the DBMS - DBMS Installation Basics Hardware Requirements - Storage Requirements Memory Requirements Configuring the DBMS - Connecting the DBMS to Supporting Infrastructure Software - Installation Verification - DBMS Environments - Upgrading DBMS Versions and Releases - Fallback Planning - Migration Verification

UNIT II DATABASE SECURITY, BACKUP AND RECOVERY

10

Database Users - Granting and Revoking Authority - Types of Privileges - Granting to PUBLIC- Revoking Privileges - Security Reporting - Authorization Roles and Groups - Using Views for Security - Using Stored Procedures for Security Auditing - SQL Injection Prevention - External Security - Job Scheduling and Security - Image Copy Backups - Full vs. Incremental Backups - Database Objects and Backups - DBMS Control - Concurrent Access Issues - Backup

Consistency - Log Archiving and Backup - DBMS Instance Backup - Designing the DBMS Environment for Recovery - Types of Recovery - Alternatives to Backup and Recovery – DBA Tools – DBA Rules of Thumb.

UNIT III FUNDAMENTALS OF TUNING 8

Review of Relational Databases – Relational Algebra – Locking and Concurrency Control – Correctness Consideration – Lock Tuning – Logging and the Recovery Subsystem – Principles of Recovery – Tuning the Recovery Subsystem – Operating Systems Considerations – Hardware Tuning.

UNIT IV INDEX TUNING AND QUERY OPTIMIZATION 9

Types of Queries – Data Structures – B tree – B+ Tree - Hash Structures – Bit Map Indexes – Clustering Indexes – Non Clustering Indexes – Composite Indexes – Hot Tables – Comparison of Indexing and Hashing Techniques. Optimization Techniques - Tuning Relational Systems – Normalization – Tuning Denormalization – Clustering Two Tables – Aggregate Maintenance – Record Layout – Query Cache – Parameter Cache - Query Tuning – Triggers – Client Server Mechanisms – Objects, Application Tools and Performance – Tuning the Application Interface – Bulk Loading Data – Accessing Multiple Databases.

UNIT V TROUBLESHOOTING 8

Query Plan Explainers – Performance Monitors – Event Monitors. Finding 'Suspicious' Queries – Analyzing Query's Access Plan – Profiling Query Execution. Tuning DBMS Subsystems - Disk Subsystem - Buffer Manager - Logging Subsystem - Locking Subsystem. Troubleshooting CPU, Disks and Controllers, Memory, and Networks.

TOTAL: 45 HOURS

REFERENCES:

1. Craig S. Mullins, "Database Administration: The Complete Guide to Practices and Procedures", Addison-Wesley Professional, 2nd edition, 2013.
2. Dennis Shasha and Philippe Bonnet, "Database Tuning, Principles, Experiments and Troubleshooting Techniques", Elsevier Reprint, 2005.
3. Silberschatz, Korth, "Database System Concepts", McGraw Hill, 6th edition, 2010.
4. Thomas Connolly and Carollyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Fourth Edition, Pearson Education, 2008.

CS35C1	INFORMATION RETRIEVAL TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of information retrieval with pertinence to modeling, query operations and indexing.
- To understand the various applications of information retrieval giving emphasis to multimedia IR, web search.
- To learn measuring effectiveness and efficiency of information retrieval techniques.

- To get used to performing Parallel Information Retrieval.
- To understand the concepts of digital libraries.

Subject Code: CS35C1		Subject Name: Information Retrieval Techniques
Course Outcome – Cos		Cognitive Skill
CO-01	Build an Information Retrieval system using the available tools.	C
CO-02	Identify and design the various components of an Information Retrieval system.	A
CO-03	Measure effectiveness and efficiency of information retrieval techniques.	E
CO-04	Use parallel Information Retrieval approaches in real world problems.	A
CO-05	Design an efficient search engine and analyze the Web content structure.	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	M	M	M	S	M	S
CO-02	S	S	M	M	S	L	M
CO-03	L	M	M	M	S	M	L
CO-04	S	L	S	S	S	M	S
CO-05	M	S	S	S	S	M	L

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I INTRODUCTION

9

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 II RETRIEVAL MODELING

9

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 III INDEXING

9

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

Processing – Relevance Feedback and Query Expansion – Automatic Local and Global Analysis
– Measuring Effectiveness and Efficiency

UNIT IV EVALUATION AND PARALLEL INFORMATION RETRIEVAL 9

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 V SEARCHING THE WEB 9

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

TOTAL: 45 HOURS

REFERENCES:

1. Ricardo Baeza – Yates, Berthier Ribeiro – Neto, “Modern Information Retrieval: The Concepts and Technology behind Search”, (ACM Press Books), Second Edition, 2011.
2. Christopher 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 Implementingand Evaluating Search Engines”, The MIT Press, Cambridge, Massachusetts London, England, 2010.

CS35C2	SERVICE ORIENTED ARCHITECTURE AND DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES

- Learn XML fundamentals.
- Be exposed to build applications based on XML.
- Understand the key principles behind SOA.
- Be familiar with the web services technology elements for realizing SOA.
- Learn the various web service standards.

Subject Code: CS35C2		Subject Name: Service Oriented Architecture and Design	
Course Outcome – Cos		Cognitive Skill	
CO-01	Understand the concepts of XML	U	
CO-02	Build applications based on XML.	C	
CO-03	Understand about Service Architecture.	U	
CO-04	Develop web services using technology elements.	C	

CO-05	Build SOA-based applications for intra-enterprise and inter-enterprise applications.	C
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R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	M	S	S	M	M	L
CO-02	M	S	S	S	M	L	N
CO-03	L	M	S	S	M	M	L
CO-04	S	L	S	S	M	M	M
CO-05	M	S	S	S	M	M	L

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I INTRODUCTION TO XML

9

XML document structure – Well formed and valid documents – Namespaces – DTD – XML Schema – X-Files.

UNIT II BUILDING XML- BASED APPLICATIONS

9

Parsing XML – using DOM, SAX – XML Transformation and XSL – XSL Formatting – Modeling Databases in XML.

UNIT III SERVICE ORIENTED ARCHITECTURE

9

Characteristics of SOA, Comparing SOA with Client-Server and Distributed architectures – Benefits of SOA — Principles of Service orientation – Service layers.

UNIT IV WEB SERVICES

9

Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Message Exchange Patterns – Orchestration – Choreography –WS Transactions.

UNIT V BUILDING SOA-BASED APPLICATIONS

9

Service Oriented Analysis and Design – Service Modeling – Design standards and guidelines — Composition – WS-BPEL – WS-Coordination – WS-Policy – WS-Security – SOA support in J2EE

TOTAL: 45 HOURS

REFERENCES:

1. Ron Schmelzer et al. “XML and Web Services”, Pearson Education, 2002.
2. Thomas Erl, “Service Oriented Architecture: Concepts, Technology, and Design”, Pearson Education, 2005.
3. Frank P.Coyle, “XML, Web Services and the Data Revolution”, Pearson Education, 2002.
4. Eric Newcomer, Greg Lomow, “Understanding SOA with Web Services”, Pearson

Education, 2005.

5. Sandeep Chatterjee and James Webber, “Developing Enterprise Web Services: An Architect’s Guide”, Prentice Hall, 2004.
6. James McGovern, Sameer Tyagi, Michael E.Stevens, Sunil Mathew, “Java Web Services Architecture”, Morgan Kaufmann Publishers, 2003.

**OPEN ELECTIVE
SEMESTER 1**

CS35C3	DISASTER MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

Subject Code: CS35C3		Subject Name: Disaster Management	
Course Outcome – Cos		Cognitive Skill	
CO-01	Differentiate the types of disasters, causes and their impact on environment and society	U, R	
CO-02	Assess vulnerability and various methods of risk reduction measures as well as mitigation.	A	
CO-03	Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management.	E, An	
CO-04	Remember and Analyze the Disaster risk Management in India	R, An	
CO-05	Remember the case studies and applications in disaster risk management.	R	

Mapping of Course Outcome with Programme Outcome

PO CO	PO- A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	L	M	N	L	M	L	M
CO-02	L	L	L	M	L	L	L
CO-03	L	L	N	L	L	L	L
CO-04	M	M	N	L	M	M	M
CO-05	M	M	N	M	M	M	M

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I INTRODUCTION TO DISASTERS

9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)

9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT

9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA

9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V **DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS**

9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

REFERENCES

1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerability India: A Geographical Study of Disasters, IAS and Sage Publishers, New Delhi, 2010.
5. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005.
6. Government of India, National Disaster Management Policy, 2009.

OPEN ELECTIVE SEMESTER 2

CS35C4	WEB ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the characteristics of web applications
- Learn to Model web applications.
- Be aware of Systematic design methods.
- Be familiar with the testing techniques for web applications

Subject Code: CS35C4		Subject Name: Web Engineering	
Course Outcome – Cos		Cognitive Skill	
CO-01	Explain the characteristics of web applications.	U, R	
CO-02	Model web applications	A	
CO-03	Design web applications.	E, S	
CO-04	Test web applications	An	
CO-05	Remember web applications and web project management	R	

Mapping of Course Outcome with Programme Outcome

PO CO	PO- A	PO- B	PO- C	PO- D	PO- E	PO- F	PO- G
CO-01	S	M	M	M	S	M	L
CO-02	M	S	M	M	S	L	N
CO-03	L	M	M	M	S	M	L
CO-04	S	L	M	M	S	M	M
CO-05	M	S	M	M	S	M	L

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I INTRODUCTION TO WEB ENGINEERING

9

Motivation, Categories of Web Applications, Characteristics of Web Applications. Requirements of Engineering in Web Applications- Web Engineering-Components of Web Engineering-Web Engineering Process-Communication-Planning.

UNIT II WEB APPLICATION ARCHITECTURES & MODELLING WEB APPLICATIONS

9

Introduction- Categorizing Architectures- Specifics of Web Application Architectures, Components of a Generic Web Application Architecture- Layered Architectures, 2-Layer Architectures, N-Layer Architectures-Data-aspect Architectures, Database-centric Architectures- Architectures for Web Document Management- Architectures for Multimedia Data- Modeling Specifics in Web Engineering, Levels, Aspects, Phases Customization, Modeling Requirements, Hypertext Modeling, Hypertext Structure Modeling Concepts, Access Modeling Concepts, Relation to Content Modeling, Presentation Modeling, Relation to Hypertext Modeling, Customization Modeling, Modelling Framework-Modeling languages Analysis Modeling for Web Apps-The Content Model-The Interaction Model-Configuration Model.

UNIT III WEB APPLICATION DESIGN

9

Design for Web Apps- Goals-Design Process-Interactive Design- Principles and Guidelines Workflow-Preliminaries-Design Steps- Usability- Issues- Information Design- Information Architecture- structuring- Accessing Information-Navigation Design- Functional Design-Web App Functionality- Design Process- Functional Architecture- Detailed Functional Design.

UNIT IV TESTING WEB APPLICATIONS

9

Introduction-Fundamentals-Test Specifics in Web Engineering-Test Approaches Conventional Approaches, Agile Approaches- Testing concepts- Testing Process -Test Scheme- Test Methods and Techniques- Link Testing- Browser Testing-Usability Testing Load, Stress, and Continuous Testing, Testing Security, Test-driven Development, -Content Testing-User Interface testing-Usability Testing-Compatibility Testing-Component Level Testing- Navigation Testing-Configuration testing-Security and Performance Testing- Test Automation.

UNIT-V PROMOTING WEB APPLICATIONS AND WEB PROJECT MANAGEMENT

9

Introduction-challenges in launching the web Application-Promoting Web Application Content Management-Usage Analysis-Web Project Management-Challenges in Web Project Management-Managing Web Team- Managing the Development Process of a Web Application- Risk, Developing a Schedule, Managing Quality, Managing Change, Tracking the Project. Introduction to node JS - web sockets.

TOTAL: 45 PERIODS

REFERENCES

1. Chris Bates, —Web Programming: Building Internet Applications, Third Edition, Wiley India Edition, 2007.
2. Gerti Kappel, Birgit Proll, —Web Engineering, John Wiley and Sons Ltd, 2006.
3. Guy W. Lecky-Thompson, —Web Programming, Cengage Learning, 2008.
4. John Paul Mueller, —Web Development with Microsoft Visual Studio 2005, Wiley Dream tech, 2006.
5. Roger S. Pressman, David Lowe, —Web Engineering, Tata McGraw Hill Publication, 2007.