118MCT01	ADVANCED MATHEMATICS FOR COMPUTING	L	T	P	C
		4	0	0	4

COURSE OBJECTIVES

- To impart the basic knowledge of random variables.
- To learn one dimensional discrete and continuous probability distributions occurring in natural phenomena.
- To introduce queuing models.
- To appreciate the use of simulation techniques.
- To acquire the knowledge of statistical techniques useful in making rational decisions.

UNIT – I RANDOM VARIABLES and PROBABILITY DISTRIBUTIONS **12**

Random variable - Probability mass function - Probability density function - Properties - Moments - Moment generating functions – properties and applications. Probability distributions- Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT – II QUEUING MODELS **12**

Introduction-Characteristics of Queueing Models- Little's Formula- Markovian Single server and multi server queuing models: (M/M/1): (∞ **/FIFO**), (M/M/s): (∞ **/FIFO**), (M/M/1): (**k/FIFO**) , (M/M/s): (**k/FIFO**), Non-Markovian Queues: Pollaczek-Khinchin formula - **(M/G/1):(∞/GD).**

UNIT – III SIMULATION **12**

Discrete Event Simulation – Monte – Carlo Simulation – Stochastic Simulation – Applications to Queuing systems.

UNIT – IV TESTING OF HYPOTHESI **12**

Sampling distributions - Tests for single Mean, Proportion, Difference of means (large andsmall samples) – Tests for single variance and equality of variances – Chi-square test for goodnessof fit – Independence of attributes.

UNIT – V LINEAR PROGRAMMING **12**

Formulation – Graphical solution – Simplex method – Two phase method -Transportation and Assignment Problems.

Total: 60 periods

COURSE OUTCOMES

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

CO 1: Imbibe the knowledge of random variables which helps to understand the various probability distributions.

CO 2: Construct and solve queuing models that are suitable for practical problems encounteredin daily life.

CO 3: Simulate appropriate application/distribution problems.

CO 4: Draw inference and decision making through hypothesis testing.

CO 5: Formulate and find optimal solution in the real life optimizing / allocation/assignment problems involving conditions and resource constraints.

REFERENCE BOOKS:

1. Ibe, O.C. "Fundamentals of Applied Probability and Random Processes", Elsevier, U.P.,1st Indian Reprint, 2007.

2. Gross, D., Shortle, J.F., Thompson, J.M. and Harris, C.M., Fundamentals of Queuing Theory, 4th Edition, John Wiley and Sons, New York, 2016.
3. Johnson, R.A. Miller and Freund"s," Probability and Statistical for Engineers, PrenticeHall of India Pvt., Ltd., New Delhi, Seventh Edition, 2005.
4. Jay L. Devore," Probability and Statistics for Engineering and the Sciences", CengageLearning, Seventh Edition, 2009.
5. Ross. S.M., "Probability Models for Computer Science", Academic Press, 2002.
6. Gupta.S.C., & Kapoor,V.K., "Fundamentals of mathematical statistics", 11th edition,Sultan Chand & Sons publishers, New Delhi, 2013.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Imbibe the knowledge of random variables which helps to understand the variousprobability distributions	3	1	3	3									1	
CO2	Construct and solve queuing models that are suitable for practical problems encounteredin daily life.	3	1	3	3		1								
CO3	Simulate appropriate application/distribution problems.	3	1	3	3					2					1
CO4	Draw inference and decision making through hypothesis testing.	3	1	3					1						
CO5	Formulate and find optimal solution in the real life optimizing/allocation/assignment problems involving conditions and resource constraints	3	2	3			2					1			

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118MCT02	ADVANCED DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		4	0	0	4

COURSE OBJECTIVES

- To extend the students' knowledge of algorithms and data structures
- To enhance their expertise in algorithmic analysis and algorithm design techniques.
- To learn a variety of useful algorithms and techniques
- To extrapolate from them in order to apply those algorithms and techniques to solve problems

UNIT I FUNDAMENTALS 9

Mathematical Proof Techniques: Induction, proof by contradiction, direct proofs – Asymptotic Notations – Properties of Big-oh Notation –Conditional Asymptotic Notation – Algorithm Analysis – Amortized Analysis – Introduction to NP- Completeness/NP-Hard – Recurrence Equations – Solving Recurrence Equations – Time-Space Tradeoff.

UNIT II HEAP STRUCTURES 9

Min/Max heaps – Deaps – Leftist Heaps – Binomial Heaps – Fibonacci Heaps – Skew Heaps Lazy – Binomial Heaps

UNIT III SEARCH STRUCTURES 9

Binary Search Trees – AVL Trees – Red-Black trees – Multi-way Search Trees –B-Trees –Splay Trees – Tries.

UNIT IV GEOMETRIC ALGORITHMS 9

Segment Trees – 1-Dimensional Range Searching – k-d Trees – Line Segment Intersection Convex Hulls – Computing the Overlay of Two Subdivisions – Range Trees – VoronoiDiagram

UNIT V PARALLEL ALGORITHMS 9

Flynn's Classifications – List Ranking – Prefix computation – Array Max – Sorting on EREW PRAM – Sorting on Mesh and Butterfly – Prefix sum on Mesh and Butterfly – Sum on mesh and butterfly – Matrix Multiplication – Data Distribution on EREW, Meshand Butterfly

Total: 45 periods

COURSE OUTCOMES

Upon completion of this course, the student should be able to

CO1: Have a basic ability to analyze algorithms and to determine algorithm correctness and time efficiency

CO2: Master a variety of advanced data structures and their implementations and different

algorithm design techniques in computational geometry and in parallel algorithms

CO3: Apply and implement the learnt algorithm design techniques and data structuresto solve problems

REFERENCES:

1. Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, "Fundamentals of Data Structures in C",Silicon Pr, 2007.
2. Gilles Brassard, Paul Bratley, "Algorithmics: Theory and Practice", Prentice Hall,1988.
3. Mark de Berg, Otfried Cheong, Marc van Kreveld, Mark Overmars, "ComputationalGeometry Algorithms and Applications", Third Edition, 2008.
4. J.A. Storer, "An Introduction to Data Structures and Algorithms", Birkhäuser Boston,2002.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", MIT Press, 2009.

	Course Outcomes	PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Have a basic ability to analyze algorithms and to determine algorithm correctness and time efficiency	3				2						1			
CO2	Master a variety of advanced data structures and their implementations and different algorithm design techniques in computational geometry and in parallel algorithms	3		1			2							2	
CO3	Apply and implement the learnt algorithm design techniques and data structuresto solve problems	3	2				2						1		

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118MCT03	ADVANCED COMPUTER ARCHITECTURE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the students to the recent trends in the field of Computer Architectureand identify performance related parameters.
- To learn the different multiprocessor issues.
- To expose the different types of multicore architectures.
- To understand the design of the memory hierarchy.

UNIT I FUNDAMENTALS OF COMPUTER DESIGN AND ILP 9

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

UNIT II MEMORY HIERARCHY DESIGN 9

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

UNIT III MULTIPROCESSOR ISSUES 9

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

UNIT IV MULTICORE ARCHITECTURES 9

Homogeneous and Heterogeneous Multi-core Architectures – Intel Multicore Architectures –SUN CMP architecture – IBM Cell Architecture. Introduction to Warehouse-scale computers- Architectures- Physical Infrastructure and Costs- Cloud Computing –Case Study- Google Warehouse-Scale Computer.

UNIT V VECTOR, SIMD AND GPU ARCHITECTURES 9

Introduction-Vector Architecture – SIMD Extensions for Multimedia – Graphics Processing Units – Case Studies – GPGPU Computing – Detecting and Enhancing Loop Level Parallelism-Case Studies.

Total: 45 period

COURSE OUTCOMES

Upon completion of this course, the students should be able to:

CO 1: Discuss the issues related to multiprocessing and suggest solutions

CO 2: Point out the salient features of different multicore architectures and how they exploit parallelism.

CO 3: Design hierarchal memory system

CO 4: Point out how data level parallelism is exploited in architectures

REFERENCES:

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

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Discuss the issues related to multiprocessing and suggest solutions	3				1	3								
CO2	Point out the salient features of different multicore architectures and how theyexploit parallelism	3	1		2				1					1	
CO3	Design hierarchal memory system	3		3				1							
CO4	Point out how data level parallelism is exploited in architectures	3			2			1				1			

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118MCT04	NETWORK PROTOCOLS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the existing network architecture models and analyze the theirperformance
- To understand the high speed network protocols and design issues.
- To learn network security technologies and protocols
- To study various protocols in wireless LAN, MAN.

UNIT I FUNDAMENTALS OF NETWORKING STANDARDS AND PROTOCOLS 9

Network Communication Architecture and Protocols - OSI Network Architecture seven LayersModel - Definition and Overview of TCP/IP Protocols -TCP/IP Four Layers Architecture Model - Other Network Architecture Models: IBM SNA.

UNIT II ROUTED AND ROUTING PROTOC 9

Application Layer Protocols – Presentation Layer Protocols – Session Layer Protocols – Transport Layer Protocols – Network Layer Protocols – Data Link Layer Protocols – Routing Protocols – Multicasting Protocols – MPLS.

UNIT III ISDN AND NETWORK MANAGEMENT PROTOCOLS 9

Overview of ISDN – Channels – User access – Protocols Network management requirements – Network monitoring – Network control – SNMP V1, V2 and V3 – Concepts, MIBs – Implementation issues – RMON.

UNIT IV SECURITY PROTOCOLS 9

Network Security Technologies and Protocols - AAA Protocols - Tunneling Protocols - Secured Routing Protocols – IP telephony -Voice over IP and VOIP Protocols –Signaling Protocols- Media/CODEC

UNIT V NETWORK ENVIRONMENTS AND PROTOCOLS 9

Wide Area Network and WAN Protocols - Frame relay - ATM - Broadband Access Protocols – PPP Protocols - Local Area Network and LAN Protocols - Ethernet Protocols - Virtual LANProtocols - Wireless LAN Protocols - Metropolitan Area Network and MAN Protocol - Storage Area Network and SAN Protocols.

Total: 45 periods

COURSE OUTCOMES

CO 1: Ability to study, analyze and design seven layers of protocols of wired and wireless networks.

CO 2: Understand the network security technologies and protocols

CO 3: Gain the knowledge to design various high speed network protocols

CO 4: Understand the importance of Wireless LAN & MAN protocols

REFERENCES:

1. Javvin, "Network Protocols" , Javvin Technologies Inc , second edition, 2005
2. Mani Subramanian, "Network Management–Principles and Practices", Addison Wesley,2000.
3. William Stallings, "SNMP, SNMPV2, SNMPV3 and RMON1 and 2", 3rd Edition,Addison Wesley, 1999.
4. William Stallings, "Data and Computer Communications" 5th Edition, PHI, 1997.

Course Outcomes		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Ability to study, analyze and design seven layers of protocols of wired and wirelessnetworks.	3		1	3						1			1	
CO2	Understand the network securitytechnologies and protocols	3							2					2	
CO3	Gain the knowledge to design various high speed network protocols	3	1	3										1	
CO4	Understand the importance of Wireless LAN & MAN protocols	3				2									

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118MCT05	ADVANCED SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To comprehend software development process and formal specifications
- To know advanced software development techniques and its application in real world context
- To understand how to manage complex projects
- To use advanced software testing techniques
- To understand process improvement and re engineering

UNIT I SOFTWARE ENGINEERING PROCESS AND FORMAL METHODS 9

Software Process models – Software Life Cycle – Development Activities – Managing Software Development – Unified Modeling Language – Requirement elicitation and specification – Understanding formal methods – motivation for formal methods – informal requirements to formal specifications – validating formal specifications – Overview of Z specification

UNIT II AGILE AND ASPECT ORIENTED SOFTWARE ENGINEERING 9

Agile Development: Agility – agile principles- Extreme Programming – Agile process models – Agile modeling – Agile unified Process – tools set for agile process – Complex Projects: SCRUM – basics, SCRUM Process, Development using SCRUM – Aspect Oriented Software Development: Aspect – Orientation in the Software Lifecycle – Generic Aspect – Oriented Design with UML – Modeling for Aspect – Oriented Software Development – Developing Secure Applications Through Aspect-Oriented Programming.

UNIT III COMPONENT BASED SOFTWARE ENGINEERING 9

Engineering of component-based systems, the CBSE process–Designing class based components–component design for Web Apps–Component-based development– Component-level design pattern–Classifying and retrieving components, and economics of CBSE

UNIT IV ADVANCED SOFTWARE TESTING TECHNIQUES 9

Software Review – Testing Strategies - Testing Conventional Applications – Testing Object-Oriented Applications – Testing Web Applications – Formal Modeling and verification – Metrics : Product, process, project, testing and quality metrics – Software Test Automation

UNIT V SOFTWARE PROCESS IMPROVEMENT AND REENGINEERING 9

SPI process–CMMI–SPI frameworks–SPI Trends–Emerging trends ion Software Engineering–identifying soft trends –Technology directions–Tool-related trends–Software Maintenance and Reengineering: software reengineering, reverse reengineering, restructuring, forward reengineering.

Total : 45 Hours

COURSE OUTCOMES

Upon completion of this course, the student should be able to

CO 1: Analytically apply general principles of software development in the development of complexsoftware and software- intensive systems

CO 2: Discuss methods and techniques for advanced software development and also to be able to usethese in various development situations

CO 3: Apply testing techniques for object oriented software and web-based systems

REFERENCES:

1. Roger S. Pressman, "Software Engineering – A Practioner‟s Approach", MCGraw Hill,7th edition, 2009.
2. Ian Sommerville, "Software Engineering", Addison-Wesley 9th Edition, 2010
3. Bernd Bruegge, Allen H. Dutoit, "Object-Oriented Software Engineering", Prentice Hall,Third Edition, 2009.
4. Robert E. Filman, Tzilla Elrad, Siobhán Clarke, Mehmet Aksit, "Aspect-Oriented Software Development", Addison-Wesley Professional, 2004.
5. Renu Rajni, Pradeep Oak, "Software Testing: Effective Methods, Tools and Techniques",Tata McGraw Hill, 2004.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Analytically apply general principles of software development in the development of complexsoftware and software- intensive systems	3	2		3			2		1				1	
CO2	Discuss methods and techniques for advanced software development and also to be able to usethese in various development situations	3		1			2							1	
CO3	Apply testing techniques for object oriented software and web-based systems	3		3	3			2				1	1		

118MCP07 Advanced Data Structures LABORATORY

COURSE OBJECTIVES

- To acquire the knowledge of using advanced tree structures.
- To learn the usage of heap structures.
- To understand the usage of graph structures and spanning trees.

LIST OF EXPERIMENTS:

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

COURSE OUTCOMES

Upon Completion of this course, the students will be able to:

CO 1: Design and implement basic and advanced data structures extensively.

CO 2: Design algorithms using graph structures

CO 3: Design and develop efficient algorithms with minimum complexity using design techniques.

SOFTWARE REQUIRED

Operating System : Windows/Linux

Language : Turbo C++

Course Outcomes		PSO1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Design and implement basic and advanced data structures extensively.	3		2						1					
CO2	Design algorithms using graph structures	3		3		3							1		
CO3	Design and develop efficient algorithms with minimum complexity using design techniques	3	2				3							1	

NETWORKS SIMULATIONLABORATORY

118MCP08

L	T	P	C
0	0	2	1

COURSE OBJECTIVES

- To get some exposure to one of the most useful tools in Network research and development.
- Understand and design network topology using NS2.
- Understand and design wireless and wired network using NS2.
- Understand the scenario and study the performance of various network protocols through simulation.
- Understand the basic concepts of cyclic codes, and explain how cyclic redundancy check works.

LIST OF EXPERIMENTS:

1. Simulate a three nodes point-to-point network with duplex links between them. Set thequeue size and varythe bandwidth and find the number of packers dropped.
2. Simulate a four node point-to-point network and connect the links as follows: n0 –n2, n1– n2 and n2- n Apply TCP agent between n0 – n3 and UDP n1 – n3.
3. Apply relevant applications over TCP and UDP agents changing the parameter anddetermine the number of packets sent byTCP / UDP.
4. Simulate the transmission of ping messages over a network topology consisting of 6nodes and find the number of packers dropped due to congestion.

5. Simulate an Ethernet LAN using N nodes (6-10). Change error rate and data rate andcompare throughput.
6. Simulate an Ethernet LAN using N nodes and set multiple traffic nodes and plotcongestion window for different source / destination.
7. Simulate simple ESS and with transmitting nodes in wireless LAN by simulation anddetermine the performance with respect to transmission of packets.
8. Write a program for error detecting code using CRC-CCITT (16-bits).
9. Write a program for distance vector algorithm to find suitable path for transmission.
10. Using TCP/IP sockets, write a client server program to make client sending the file nameand the server to send back the contents of the requested file if present.
11. Implement the above program using as message queues or FIFOs as IPC channels.
12. Write a program for simple RSA algorithm to encrypt and decrypt the data.
13. Write a program for congestion control using leaky bucket algorithm

COURSE OUTCOMES

At the end of the course, the students will be able to:

CO 1: Learn the basic idea about open source network simulator NS2 and how todownload, install and work with NS2 using TCL programming.

CO 2: Defining the different agents and their applications like TCP, FTP over TCP, UDP,CBR and CBR over UDP etc.

CO 3: Identifying and solving the installation error of NS2.

CO 4: Understand the basic concepts of link layer properties including error-detection.

CO 5: Understand the basic concepts of application layer protocol design including Client/server models.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Learn the basic idea about open source network simulator NS2 and how todownload, install and work with NS2 using TCL programming	3							3					2	
CO2	Defining the different agents and their applications like TCP, FTP over TCP, UDP,CBR and CBR over UDP etc	3	2						3					2	
CO3	Identifying and solving the installation error of NS2.	3							3					2	
CO4	Understand the basic concepts of link layer properties including error-detection	3		3										2	

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CO5	Understand the basic concepts of application layer protocol design includingClient/server models	3							1					

SOFTWARE REQUIRED:

Operating System : Windows/Linux
Simulator : NS2

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118MCE01	ADVANCED WIRELESS NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To study about advanced wireless network, LTE, 4G and Evolutions from LTE to LTE.
- To study about wireless IP architecture, Packet Data Protocol and LTE network architecture
- To study about adaptive link layer, hybrid ARQ and graphs routing protocol.
- To study about mobility management, cellular network, and micro cellular networks

UNIT I INTRODUCTION 9

Introduction to 1G/2G/3G/4G Terminology. Evolution of Public Mobile Services -Motivation forIP Based Wireless Networks -Requirements and Targets for Long Term Evolution (LTE) - Technologies for LTE-4G Advanced Features and Roadmap Evolutions from LTE to LTE-A - Wireless Standards. Network Model-Network Connectivity-Wireless Network Design with SmallWorld Properties

UNIT II WIRELESS IP NETWORK ARCHITECTURES 9

3GPP Packet Data Networks -Network Architecture -Packet Data Protocol (PDP) Context - Configuring PDP Addresses on Mobile Stations -Accessing IP Networks through PS Domain – LTE network Architecture -Roaming Architecture-Protocol Architecture-Bearer Establishment Procedure -Inter-Working with other RATs.

UNIT III ADAPTIVE LINK AND NETWORK LAYER 9

Link Layer Capacity of Adaptive Air Interfaces-Adaptive Transmission in Ad Hoc Networks- Adaptive Hybrid ARQ Schemes for Wireless Links-Stochastic Learning Link Layer Protocol- Infrared Link Access Protocol-Graphs and Routing Protocols-Graph Theory-Routing with Topology Aggregation-Network and Aggregation Models

UNIT IV MOBILITY MANAGEMENT 9

Cellular Networks-Cellular Systems with Prioritized Handoff-Cell Residing Time Distribution- Mobility Prediction in Pico-and Micro-Cellular Networks

UNIT V QUALITY OF SERVICE 9

QoS Challenges in Wireless IP Networks -QoS in 3GPP -QoS Architecture, Management and Classes - QoS Attributes -Management of End-to-End IP QoS -EPS BearersandQoSin LTE networks.

Total: 45 period

COURSE OUTCOME

At the end of the course the students are able to

CO 1: Familiar with the latest 4G networks and LTE
CO 2: Understand about the wireless IP architecture and LTE network architecture.
CO 3: Familiar with the adaptive link layer and network layer graphs and protocol.
CO 4: Understand about the mobility management and cellular network.
CO 5: Understand about the wireless sensor network architecture and its concept.

REFERENCES:

1. Ayman ElNashar, Mohamed El-saidny, Mahmoud Sherif, "Design, Deployment and Performance of 4G-LTE Networks: A Practical Approach", John Wiley & Sons, 2014.
2. Crosspoint Boulevard, "Wireless and Mobile All-IP Networks", Wiley Publication, 2005.
3. Jyh-Cheng Chen and Tao Zhang, "IP-Based Next-Generation WirelessNetworks Systems, Architectures, and Protocols", John Wiley & Sons, Inc. Publication,2006.
4. Minoru Etoh, "Next Generation Mobile Systems3G and Beyond," Wiley Publications,2005.
5. Stefania Sesia, IssamToufik and Matthew Baker, "LTE –The UMTS Long Term Evolution From Theory to Practice", John Wiley & Sons, Inc. Publication, Second Edition, 2011.
6. Savo Glisic,"advanced wireless networks-technology and business models",Third Edition,JohnWiley & Sons, Ltd, 2016.
7. Savo Glisic,"Advanced Wireless Networks-4G Technologies",John Wiley & Sons, Ltd,2006

	Course Outcomes	PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Familiar with the latest 4G networks and LTE .	3							3					1	
CO2	Understand about the wireless IP architecture and LTE network architecture.	3									1				
CO3	Familiar with the adaptive link layer and network layer graphs and protocol.	3	2										1		
CO4	Understand about the mobility management and cellular network.	3						2							2
CO5	Understand about the wireless sensor network architecture and its concept.	3		3			3		3	1					

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118MCE02	DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the image processing concepts and analysis
- To understand the image processing techniques
- To familiarize the image processing environment and their applications.
- To appreciate the use of image processing in various applications

UNIT I IMAGE PROCESSING FUNDAMENTALS 9

Introduction –Elements of visual perception, Steps in Image Processing Systems –Digital ImagingSystem -Image Acquisition –Sampling and Quantization –Pixel Relationships –File Formats – colour images and models -Image Operations –Arithmetic, logical, statistical and spatial operations.'

UNIT II IMAGE ENHANCEMENT AND RESTORATION 9

Image Transforms-Discrete and Fast Fourier Transform and Discrete Cosine Transform ,Spatial Domain -Gray level Transformations Histogram Processing Spatial Filtering –Smoothing and Sharpening. Frequency Domain: Filtering in Frequency Domain –Smoothing and Sharpening filters –Homomorphic Filtering., Noise models, Constrained and Unconstrained restoration models.

UNIT III IMAGE SEGMENTATION AND MORPHOLOGY 9

Detection of Discontinuities –Edge Operators –Edge Linking and Boundary Detection – Thresholding – Region Based Segmentation –Motion Segmentation, Image Morphology: Binary and Gray level morphology operations -Erosion, Dilation, Opening and Closing OperationsDistance Transforms-Basic morphological Algorithms. Features –Textures -Boundary representations and Descriptions-Component Labeling –Regional descriptors and Feature Selection Techniques.

UNIT IV IMAGE ANALYSIS AND CLASSIFICATION 9

Image segmentation-pixel based, edge based, region based segmentation. Active contour models and Level sets for medical image segmentation, Image representation and analysis, Feature extraction and representation, Statistical, Shape, Texture, feature and statistical imageclassification.

UNIT V IMAGE REGISTRATIONAND VISUALIZATION 9

Rigid body visualization, Principal axis registration, Interactive principal axisregistration, Featurebased registration, Elastic deformation based registration, Image visualization –2D display methods, 3D display methods, virtual reality based interactive visualization.

Total: 45 periods

COURSE OUTCOMES

At the end of the course the students are able to

CO 1: Design and implement algorithms for image processing applications that incorporatesdifferent concepts of medical Image Processing

CO 2: Familiar with the use of MATLAB and its equivalent open source tools

CO 3: Critically analyze different approaches to image processing applications
CO 4: Explore the possibility of applying Image processing concepts in various applications

REFERENCES:

1. Alasdair McAndrew, —Introduction to Digital Image Processing with Matlab , Cengage Learning 2011,India.
2. Anil J Jain, -Fundamentals of Digital Image Processing , PHI, 2006.
3. KavyanNajarian and Robert Splerstor,Biomedical signals and Image Processing,CRC –Taylor and Francis, New York, 2006.
4. Rafael C.Gonzalez and Richard E.Woods, —Digital Image Processing, Third Edition, Pearson Education, 2008, New Delhi.
5. S.Sridhar, —Digital Image Processing , Oxford University Press, 2011.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Design and implement algorithms for image processing applications that incorporates different concepts of medical Image Processing	3	3											1	
CO2	Familiar with the use of MATLAB and its equivalent open source tools	3							2						
CO3	Critically analyze different approaches to image processing applications	3							2						
CO4	Explore the possibility of applying Image processing concepts in various applications	3		3											

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18MCE03 **AGILE SOFTWARE ENGINEERING**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The student should be able to

- Understand agile software development practices
- Demonstrate Agile development and testing techniques
- Know the benefits and pitfalls of working in an Agile team
- Understand agile development and testing.

UNIT I AGILE METHODOLOGY 9

Theories for Agile management –agile software development –traditional model vs. agile model - classification of agile methods –agile manifesto and principles –agile project management –agile team interactions –ethics in agile teams -agility in design, testing –agile documentations –agile drivers, capabilities and values.

UNIT II AGILE PROCESSES 9

Lean production -SCRUM, Crystal, Feature Driven Development, Adaptive Software Development, and Extreme Programming: Method overview –lifecycle –work products, roles andpractices.

UNIT IIIAGILITY AND KNOWLEDGE MANAGEMENT 9

Agile information systems –agile decision making -Earl schools of KM –institutional knowledge evolution cycle –development, acquisition, refinement, distribution, deployment , leveraging –KMin software engineering –managing software knowledge –challenges of migrating to agile methodologies –agile knowledge sharing –role ofstory-cards –Story-card MaturityModel(SMM).

UNIT IVAGILITY AND REQUIREMENTS ENGINEERING 9

Impact of agile processes in RE –current agile practices –variance –overview of RE using agile – managing unstable requirements –requirements elicitation –agile requirements abstraction model– requirements management in agile environment, agile requirements prioritization –agile requirements modeling and generation –concurrency in agile requirements generation.

UNIT V AGILITY AND QUALITY ASSURANCE 9

Agile Interaction Design -Agile product development –Agile Metrics –Feature Driven Development (FDD) –Financial and Production Metrics in FDD –Agile approach to Quality Assurance -Test Driven Development –Pair programming: Issues and Challenges -Agile approach to Global Software Development.

Total: 45 periods

COURSE OUTCOMES

At the end of the course the students are able to

CO 1: The know importance of interacting with business stakeholders in determining the requirements for a software system.

CO 2: Apply iterative software development process

CO 3: Apply the impact of social aspects on software development success.

REFERENCES:

1. Craig Larman, —Agile and Iterative Development: A manager Guide, Addison-Wesley, 2004.
2. David J. Anderson; Eli Schragenheim, —Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.
3. Dingsoyr, Torgeir, Dyba, Tore, Moe, Nils Brede (Eds.), —Agile Software Development, Current Research and Future Directions, Springer-Verlag Berlin Heidelberg,2010.
4. Hazza& Dubinsky, —Agile Software Engineering, Series: Undergraduate Topics in Computer Science , Springer, VIII edition, 2009.
5. Kevin C. Desouza, —Agile information systems: conceptualization, construction, and management , Butterworth-Heinemann, 2007.

course outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	The know importance of interacting with business stakeholders in determining the requirements for a software system.	3				3									
CO2	Apply iterative software development process	3					3								
CO3	Apply the impact of social aspects on software development success.	3	3	2					2						

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118MCE04	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To appreciate the use of biological aspects in building intelligent systems
- To understand the algorithms, programming and applications of Evolutionary and genetic algorithms and neural and fuzzy systems
- To appreciate the adaptation of cellular and developmental systems
- To focus on the 0 understanding of artificial immune systems and its applications
- To understand issues in developing collective and behavioral systems

UNIT I EVOLUTIONARY SYSTEMS 9

Evolutionary Systems –Artificial Evolution -Genetic Representations -Evolutionary Measures - Types of Evolutionary Algorithms -Schema Theory. Evolutionary Computation-Representation- Selection-Reproduction. Genetic Algorithms -Canonical Genetic Algorithm –Crossover-Mutation-Control Parameters –Applications. Genetic Programming -Tree-Based Representation -Building Block Genetic Programming –Applications.Evolutionary Programming –Basics –Operators - Strategy Parameters - Evolutionary Programming Implementations

UNIT II NEURAL AND FUZZY SYSTEMS 9

Neural Networks -Biological Nervous Systems -Artificial Neural Learning -Architecture. Unsupervised Learning -Self-Organizing Feature Maps. Supervised Learning –Types-Learning Rules. Radial Basis Function Networks.Reinforcement Learning –Model Free -Neural Networks and Reinforcement Learning. Fuzzy Systems-Fuzzy Sets –Logic and Reasoning –Controllers- Rough Sets.

UNIT III CELLULAR AND DEVELOPMENT SYSTEMS 9

Cellular Systems -The Basic Ingredients -Cellular Automata -Modeling -Classic Cellular Automata – Other Cellular Systems –Computation -Artificial Life -Complex Systems -Analysis and Synthesis of Cellular Systems. Developmental Systems -Potential Advantages of a Developmental Representation - Rewriting Systems -Synthesis of Developmental Systems - Evolution and Development -Defining Artificial Evolutionary Developmental Systems - Evolutionary Rewriting Systems -Developmental Programs and Processes

UNIT IV IMMUNE SYSTEMS AND COLLECTIVE SYSTEMS 9

Natural Immune systems -Classical View -Working -Constituents of Biological Immune Systems-Immunity Types -Learning the Antigen Structure -The Network Theory -The Danger Theory - Artificial Immune Systems -Algorithms -Classical View Models –Clonal Selection Theory Models-Network Theory Models -Danger Theory Models -Applications and Other AIS models Applications-Biological Self-Organization -Particle Swarm Optimization -Basics -Social NetworkStructures –Variations -Basic PSO Parameters -Optimization -Applications. Ant Colony Optimization -Cemetery Organization and Brood Care -Division of Labor –Applications

UNIT V BEHAVIORAL SYSTEMS 9

Behavioral Systems-Behavior in Cognitive Science -Behavior in Artificial Intelligence - Behavioral Systems –Behavior Based Robots –Evolution -Co-evolution -Learning and Self Reproduction of Behavioral Systems. Cultural Algorithms-Culture and Artificial Culture -CulturalAlgorithm -Belief Space

–Fuzzy Cultural Algorithms –Applications. Co-evolution –Types – Competitive and Cooperative Co-evolution.

Total: 45 periods

COURSE OUTCOMES

At the end of the course the students are able to

CO 1: Use existing open source tools to build an application using genetic approaches

CO 2: Identify different applications suitable for different types of neural networks giving justifications

CO 3: Critically analyze the use of cellular systems

CO 4: Differentiate the different models of immune systems

CO 5: Do a literature survey on applications of artificial immune systems

CO 6: Implement the Particle swarm and Ant colony algorithms within a framework and build applications

REFERENCES:

1. Claudio Mattiussi, Dario Floreano"Bio-Inspired Artificial Intelligence: Theories, Methods,and Technologies" (Intelligent Robotics and Autonomous Agents series), MIT Press, 2008.
2. Andries P. Engelbrecht, "Computational Intelligence: An Introduction", 2nd Edition, Wiley; 2007.
3. Russell C.Eberhart, Yuhui ShiComputational Intelligence: Concepts to Implementations,Morgan Kaufmann; 1 edition 2007.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Use existing open source tools to build an application using genetic approaches	3					3								
CO2	Identify different applications suitable for different types of neural networks givingjustifications	3	2			3									
CO3	Critically analyze the use of cellular systems .	3							3						
CO4	Differentiate the different models of immune systems .	3									2				
CO5	Do a literature survey on applications of artificial immune systems	3		3						1					
CO6	Implement the Particle swarm and Ant colony algorithms within a framework and build applications	3				2			3				2		

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118MCE05	WEB ENGINEERING	L	T	P	C
		3	0	0	3

COURSE 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

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 WebApps- Goals-Design Process-Interactive Design- principles and GuidelinesWorkflow-Preliminaries-Design Steps- Usability- Issues- Information Design- Information Architecture-structuring- Accessing Information-Navigation Design- Functional Design-Wep 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 andPerformance Testing - Test Automation.

UNIT V PROMOTING WEB APPLICATIONS AND WEB PROJECT MANAGEMENT 9

Introduction-challenges in launching the web Application-Promoting Web ApplicationContent 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

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COURSE OUTCOMES

Upon completion of this course, the students should be able to:

CO 1: Explain the characteristics of web applications.

CO 2: Model web applications.

CO 3: Design web applications.

CO 4: Test web applications.

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. 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.

Course outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Explain the characteristics of web applications.	3				3									
CO2	Model web applications	3	2											2	
CO3	Design web applications	3							2						
CO4	Test web applications.	3		3				2	2						1

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Knchnagiri (Dt), Tamil Nadu.

218MCT01	ADVANCED DATABASE MANAGEMENTSYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To learn the fundamentals of data models and to represent a database system using ER diagrams.
- To study Object Oriented, Parallel database design and the Distributed Database Design
- To have an introductory knowledge about the Query processing and Query optimization Techniques

UNIT –I INTRODUCTION 9

History of Database Systems. Data base System Applications, data base System VS file System; Data Models: ER Model, relational model, other models; Database Languages: DDL, DML; Introduction to the Relational Model: Integrity constraint over relations, Enforcing integrity constraints, querying relational data, logical data base design; Introduction to Views: Destroying,altering tables and views; Introduction of object database systems: Structured data types, operations on structured data, encapsulation and ADTS, Inheritance.

UNIT –II ORDBMS 9

Database design for ORDBMS, ORBMS implementation and challenges, OODBMS, comparison of RDBMS, OODBMS and ORDBMS. Introduction to Parallel databases, architectures for parallel databases, Parallel Query Evaluation: Data partitioning and parallelizing sequential operator evaluation code, parallelizing individual operations, and parallel query optimization.

UNIT –III DISTRIBUTED DATABASES 9

Introduction to distributed databases: Features of distributed databases vs centralized databases, Why distributed databases. DDBMS: Levels of transparency, reference architecture for DDB, types of data fragmentation, distribution transparency for read-only and update applications, distributed database access primitives, Integrity constraints in distributed databases.

UNIT –IV DISTRIBUTED DATABASE DESIGN 9

Distributed database design: framework for distributed database design, the design of database fragmentation, allocation of fragments; Distributed Query processing: Equivalence of transformations for queries, transforming global queries into fragment queries, distributed grouping and aggregation functions, parametric queries.

UNIT –V QUERY OPTIMIZATION 9

A framework for query optimization, join queries and general queries. non-join queries in a distributed DBMS, joins in a distributed DBMS, cost based query optimization. DBMS Vs IR systems, Introduction to Information retrieval, Indexing for text search, web search engine, managing text in a DBMS, a data model for XML, Querying XML data, and efficient evaluationof XML queries.

Total: 45 periods

COURSE OUTCOMES

Upon Completion of this course, students should be able to

CO 1: Map ER model to Relational model to perform database design effectively

CO 2: Design different types of databases
CO 3: Compare and contrast various indexing strategies in different database systems
CO 4: Use different query optimization techniques

TEXT BOOKS :

1. Raghuramakrishnan and Johannes Gehrke, "Database Management Systems", 3rdEdition, TMH, 2006.
2. S Ceri and G Pelagatti, "Distributed databases principles and systems", 1stEdition, TMH,2008.

REFERENCE BOOKS:

1. Silberschatz, Korth, "Database System Concepts", 6thEdition, TMH, 2010.
2. Elmasri R, Navathe S B, Somayajulu D V L N, and Gupta S K, "Fundamentals of Database Systems", 5thEdition, Pearson Education,2009.
3. C. J. Date, "Introduction to Database Systems", 8thEdition, Pearson Education, 2009

	Course Outcomes	PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Map ER model to Relational model to perform database design effectively	3			2										
CO2	Design different types of databases	3					3								
CO3	Compare and contrast various indexing strategies in different database systems	3	2					1							
CO4	Use different query optimization techniques	3		3				1							

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218MCT02	SECURITY IN COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the basics of cryptography and encryption Standards
- To know the different kinds of security threats in networks.
- To learn the concept of database and data mining security.
- To gain knowledge about security over networks.
- To learn about the economics of cyber security and ethical issues in Computer Security

UNIT-I SECURITY PROBLEM & CRYPTOGRAPHY 9

Security Problem in Computing – Attacks-The Meaning of Computer Security-Computer Criminals-Methods of Defense-Terms and Concepts-Cryptography-Terminology and Background-Substitution Ciphers-Transpositions (Permutations)- Making a Good EncryptionAlgorithms- The Data Encryption Standard-The Data Encryption Standard-The AES Encryption Algorithm-Public Key Encryption-The Uses of Encryption.

UNIT-II PROGRAM SECURITY 9

Program Security-Secure Programs-Non malicious Program Errors-Viruses and Other Malicious Code-Targeted Malicious Code-Controls against Program Threats- Program Threats and Controls.

UNIT III DATABASE AND DATA MINING SECURITY 9

Database and Data Mining Security-Introduction to Databases-Security Requirements-Reliabilityand Integrity-Sensitive Data-Inference-Multilevel Databases-Proposals for Multilevel Security- Data Mining-Privacy Concepts, Principles and Policies-Authentication and Privacy-Privacy on theWeb-E-Mail Security-Impacts on Emerging Technologies.

UNIT-IV SECURITY IN NETWORKS 9

Security in Networks-Network Concepts-Threats in Networks-Network Security Controls- Firewalls-Intrusion Detection Systems-Secure E-Mail-Summary of Network Security.

UNIT-V THE ECONOMICS OF CYBERSECURITY 9

The Economics of Cyber security -Making a Business Case-Quantifying Security-Modeling Cybersecurity-Current Research and Future Directions-Legal and Ethical Issues in Computer Security- Protecting Programs and Data-Information and the Law- Rights of Employees and Employers- Redress for Software Failures-Computer Crime-Ethical Issues in Computer Security.

Total: 45 periods

COURSE OUTCOMES

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

CO 1: Summarize the basic concept of cryptography and encryption standards.
CO 2: identify and classify various kinds of threats
CO 3: Provide secure database systems.
CO 4: accomplish the security over networks.
CO 5: Familiar about economics of Cyber and ethical issues security

REFERENCE:

1. Charles P. Pfleeger and Shari Lawrence Pfleeger, "Security in Computing", 4th Edition Pearson.

	Course Outcomes	PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Summarize the basic concept of cryptography and encryption standards.	3				3								1	
CO2	identify and classify various kinds of threats	3				3									
CO3	Provide secure database systems	3	2				2							1	
CO4	accomplish the security over networks	3												2	
CO5	Familiar about economics of Cyber and ethical issues security	3		3						1				2	

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218MCT03	DATA MINING TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To Understand Data mining principles and techniques and Introduce DM as a cuttingedge business intelligence
- To expose the students to the concepts of Datawarehousing Architecture and Implementation
- To study the overview of developing areas –Web mining, Text mining and ethical aspectsof Data mining
- To identify Business applications and Trends of Data mining

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 datamining, 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 DATAMINING 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 –Applicationsin Data mining

Total: 45 periods

COURSE OUTCOMES

At the end of the course the students are able to

CO 1: Evolve Multidimensional Intelligent model from typical system

CO 2: Discover the knowledge imbibed in the high dimensional system

CO 3: Evaluate various mining techniques on complex data objects

TEXT BOOK:

1. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers, third edition2011, ISBN: 1558604898.
2. Alex Berson and Stephen J. Smith, " Data Warehousing, Data Mining & OLAP", Tata McGraw Hill Edition, Tenth Reprint 2007.
3. G. K. Gupta, "Introduction to Data Min Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India,2006.
4. Data Mining:Practical Machine Learning Tools and Techniques,Third edition,(Then Morgan Kufmann series in Data Management systems), Ian.H.Witten, Eibe Frank and Mark.A.Hall, 2011.
5. Statistical and Machine learning –Learning Data Mining, techniques for better Predictive Modeling and Analysis to Big Data.

	Course Outcomes	PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Evolve Multidimensional Intelligent model from typical system	3				3							1		
CO2	Discover the knowledge imbibed in the high dimensional system	3	2		3						1				
CO3	Evaluate various mining techniques on complex data objects	3		3				3				1			

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		L	T	P	C
218MCT04	INTERNET OF THINGS	3	0	0	3

COURSE 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.

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 RASPERRY 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 9

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 periods

COURSE OUTCOMES

At the end of the course the students are able to

CO 1: Develop web services to access/control IoT devices.
CO 2: Design a portable IoT using Rasperry Pi
CO 3: Deploy an IoT application and connect to the cloud.
CO 4: Analyze applications of IoT in real time scenario

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 Internetof

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 NewAge of Intelligence", Elsevier, 2014.
5. Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things –Key applications and Protocols, Wiley, 2012.

	Course Outcomes	PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Develop web services to access/control IoT devices .	3	2				3								
CO2	Design a portable IoT using Rasperry Pi	3							3						
CO3	Deploy an IoT application and connect to the cloud..	3		3					3						
CO4	Analyze applications of IoT in real time scenario .	3												2	

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218MCT05	OPERATING SYSTEM INTERNALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To be able to read and understand sample open source programs and header files.
- To learn how the processes are implemented in linux.
- To understand the implementation ofthe Linux file system.
- To study Linux memory management data structures and algorithms.
- To acquire the knowledge in the implementation of interprocess communication.
- To understand how program execution happens in Linux.

UNIT I INTRODUCTION 9

Basic Operating System Concepts - Overview of Unix File System - Files - Links - Types - Inodes -Access Rights - System Calls - Overview of Unix Kernels -Model - Implementation - Reentrant Kernels - Address Space - Synchronization - Interprocess Communication - ProcessManagement - Memory Management - Device Drivers.

UNIT II PROCESSES 9

Processes, Lightweight Processes, and Threads - Process Descriptor - State - Identifying a Process - Relationships among processes - Organization - Resource Limits - Creating Processes - System Calls - Kernel Threads - Destroying Processes -Termination - Removal.

UNIT III FILE SYSTEM 9

The Virtual File System (VFS) - Role - File Model -System Calls - Data Structures - Super Block, Inode, File, dentry Objects - dentry Cache - Files Associated with a Process - Filesystem Types - Special Filesystems - Filesytem Type Registration - Filesytem Handling - Namespaces -Mounting - Unmounting - Implementation of VFS System Calls.

UNIT IV MEMORY MANAGEMENT 9

Page frame management -page descriptors - non-uniform memory access - memory zones - reserved page frames - zoned page frame allocator - kernel mappings - buddy system algorithm -page frame cache - zone allocator.

UNIT V PROCESS COMMUNICATION AND PROGRAM EXECUTION 9

Process Communication - Pipes -Usage - Data Structures - Creating and Destroying a Pipe - Reading From and Writing into a Pipe. Program Execution - Executable Files - Process Credentials - Command-Line Arguments and Shell Environment - Libraries - Program Segmentsand Process Memory Regions - Execution tracing - Executable Formats - Execution Domains - The exec Functions

Total: 45 periods

COURSE OUTCOMES

At the end of this course, the students should be able to:

CO 1: Explain the functionality of a large software system by reading its source.

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CO 2: Revise any algorithm present in a system.

CO 3: Design a new algorithm to replace an existing one.

CO 4: Use the data structures of the linux kernel for a different software system.

REFERENCES:

1. Daniel P. Bovet and Marco Cesati, "Understanding the Linux Kernel", 3rd Edition, O'Reilly Publications, 2005.
2. Harold Abelson, Gerald Jay Sussman and Julie Sussman, Structure and Interpretation of Computer Programs , Second Edition, Universities Press, 2013.
3. Maurice J. Bach, —The Design of the Unix Operating System 1st Edition Pearson Education, 2003.
4. Michael Beck, Harald Bohme, Mirko Dziadzka, Ulrich Kunitz, Robert Magnus, DirkVerworner, —Linux Kernel Internals , 2nd Edition, Addison-Wesley, 1998.
5. Robert Love, —Linux Kernel Development , 3rd Edition, Addison-Wesley, 2010.

	Course Outcomes	PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Explain the functionality of a large software system by reading its source	3		3	3										
CO2	Revise any algorithm present in a system.	3	2			3									
CO3	Design a new algorithm to replace an existing one	3					2								
CO4	Use the data structures of the linux kernel for a different software system.	3					2								

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218MCP07	ADVANCED DATABASE MANAGEMENTSYSTEMS LABORATORY	L	T	P	C
		0	0	2	1

PREREQUISTIES: Database Management Systems

COURSE OBJECTIVES

- To understand and implement manipulations in DBMS
- To learn and create a distributed DBMS
- To design a ER model for database
- To develop and create a search engine

LIST OF EXERCISES:

1. Implementation of Views and Constraints In Database Management Systems.
2. Object Oriented Database-ER Model For University Database.
3. Parallel Query Processing and Evaluation-Implementation Of Efficient Query Optimizer.
4. Parallel Database-University Counselling For Engineering Colleges.
5. Distributed Database For Book Store.
6. Implementation Of Grouping and Aggregate Functions In Distributed DBMS.
7. Implementation Of Join Queries In Distributed DBMS.
8. Implementation Of Non Join Queries In Distributed DBMS.
9. Simulation Of Search Engine.
10. Designing XML Schema For Company Database.

COURSE OUTCOMES

At the end of the course, the students should be able to

CO 1: Design and develop parallel and distributed database
CO 2: Create and retrieve from database with efficient query optimizer
CO 3: Simulate the search engine using XML language
CO 4: Apply join operations in distributed DBMS

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Design and develop parallel and distributed database	3		3			3								
CO2	Create and retrieve from database with efficient query optimizer	3	2				3								
CO3	Simulate the search engine using XML language	3						2							
CO4	Apply join operations in distributed DBMS	3						2							

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218MCP08

DATA MINING LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

- Learn how to build a data warehouse and query it.
- Understand the data sets and data pre-processing.
- Demonstrate the working of algorithms for data mining tasks such association rulemining, Classification, clustering and regression.
- To obtain Practical Experience Working with all real data sets.

LIST OF EXPERIMENTS:

1. Build Data Warehouse and Explore WEKA.
2. Demonstration of preprocessing on dataset student.arff.
3. Demonstrate Performing association rule mining on data sets.
4. Demonstration of Association rule process on dataset test.arff using apriori algorithm.
5. Demonstration of classification rule process on dataset employee.arff using naïve bayes algorithm.
6. Demonstration of clustering rule process on dataset student.arff using simple k-means.
7. Demonstrate performing classification on data sets.
8. Demonstrate performing clustering on data sets.
9. Demonstrate performing Regression on data sets.
10. Credit Risk Assessment using German Credit Data.
11. Case Study on Text Mining.
12. Implementation of ERP.

COURSE OUTCOMES:

CO 1: Ability to understand and create data warehouse.
CO 2: Demonstrate the classification, clustering and etc. in large data sets.
CO 3: Ability to add mining algorithms as a component to the exiting tools.
CO 4: Ability to apply mining techniques for realistic data.
CO 5: Demonstrate the association rule mining in large data sets.

LAB REQUIREMENTS:

SOFTWARE : WEKA
HARDWARE : Standalone desktops

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Ability to understand and create data warehouse.	3			3										
CO2	Demonstrate the classification, clustering and etc. in large data sets	3	2				3								
CO3	Ability to add mining algorithms as a component to the exiting tools	3						2							
CO4	Ability to apply mining techniques for realistic data	3		3				2							
CO5	Demonstrate the association rule mining in large data sets.	3					3								

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218MCE01	AD HOC NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To study the fundamental concepts and various applications developed basedon Ad Hoc Networking.
- To study the design issues and solution to the issues of the various protocolsdeveloped in Ad Hoc Networking.
- To lay foundation on medium access control, routing, transport and securitylayer protocol in Ad Hoc Networks.
- To understand the quality of service provisioning and energy management inAd Hoc Wireless Networking.

UNIT-I AD HOC WIRELESS NETWORK AND MAC PROTOCOL 9

Introduction - Issues in Ad Hoc Wireless Networks – Ad Hoc Wireless Internet – Issuesin Designing a MAC Protocol for Ad Hoc Wireless Networks – Design Goals of a MACProtocol for Ad Hoc Wireless Networks – Classifications of MAC Protocols – Contention Based Protocols - Contention Based Protocols with Reservation Mechanisms - Contention Based MAC Protocols with Scheduling Mechanisms

UNIT-II AD HOC ROUTING PROTOCOLS 9

Introduction - Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks-Classifications of Routing Protocols -Table-Driven Routing Protocols - Destination Sequenced Distance Vector - Wireless Routing Protocol - Cluster Switch Gateway Routing – Source Tree Adaptive Routing Protocols - On-Demand Routing Protocols - Dynamic Source Routing - Ad Hoc On-Demand Distance Vector Routing - TemporallyOrdered Routing Algorithm - Location-Aided Routing - Signal Stability Routing - ZoneRouting Protocol - Power-Aware Routing

UNIT-III MULTICASTROUTING IN AD HOC NETWORKS 9

Introduction - Issues in Designing a Multicast Routing Protocol - Operation of MulticastRouting Protocols - An Architecture Reference Model for Multicast RoutingProtocols-Classifications of Multicast Routing Protocols - Tree-Based Multicast Routing Protocols- Mesh-Based Multicast Routing Protocols - Summary of Tree-and Mesh- Based Protocols - Energy-Efficient Multicasting - Multicasting with Quality of ServiceGuarantees – Application Dependent Multicast Routing

UNIT–IV TRANSPORT LAYER, SECURITY PROTOCOLS 9

Introduction - Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks - Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks-Classification of Transport Layer Solutions - TCP Over Ad Hoc Wireless Networks - Other Transport Layer Protocols for Ad Hoc Wireless Networks - Security in Ad Hoc Wireless Networks - Network Security Requirements - Issues and Challenges in Security Provisioning - Network Security Attacks - Key Management - Secure Routingin Ad Hoc Wireless Networks

UNIT-V QoS AND ENERGY MANAGEMENT 9

Introduction - Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks-Classifications of QoS Solutions - MAC Layer Solutions - Network Layer Solutions -QoS Frameworks for Ad Hoc Wireless

Networks - Energy Management in Ad Hoc Wireless Networks –Introduction - Need for Energy Management in Ad Hoc WirelessNetworks - Classification of Energy Management Schemes - Battery Management Schemes - Transmission Power Management Schemes - System Power Management Schemes

Total: 45 periods

COURSE OUTCOMES

At the end of the course, the student should be able to:

CO1: Explain the concepts, architecture and applications of Ad Hoc Networks.
CO2: Analyse the MAC protocol design concepts in Ad Hoc networks.
CO3: Design Ad Hoc routing protocols with respect to some protocol design issues.
CO4: Identify different Transport and Security Layer protocols
CO5: Evaluate the QOS related performance measurement of Ad Hoc Networks.

REFERENCE BOOKS:

1. C. Siva Ram Murthy and B.S. Manoj "Ad Hoc Wireless Networks: Architecturesand Protocols", PHI, 2013.
2. C.K. Toh, Ad Hoc Mobile Wireless Networks: Protocols and Systems, PHI ,2001.
3. Charles E. Perkins, Ad Hoc Networking, Addison Wesley, 2000.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Explain the concepts, architecture and applications of Ad Hoc Networks	3												1	
CO2	Analyse the MAC protocol design concepts in Ad Hoc networks	3												1	
CO3	Design Ad Hoc routing protocols with respect to some protocol design issues	3	2				3								
CO4	: Identify different Transport and Security Layer protocols.	3												1	
CO5	Evaluate the QOS related performance measurement of Ad Hoc Networks	3		3										1	

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218MCE02	MULTIMEDIA COMPRESSION TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the basic ideas of compression algorithms related to multimedia components Text,speech, audio, image and Video.
- To understand the principles and standards and their applications with an emphasis on underlyingtechnologies, algorithms, and performance.
- To appreciate the use of compression in multimedia processing applications
- To understand and implement compression standards in detail.

UNIT I FUNDAMENTALS OF COMPRESSION

Introduction To multimedia –Graphics, Image and Video representations –Fundamental concepts of video, digital audio –Storage requirements of multimedia applications –Need for compression– Taxonomy of compression Algorithms -Elements of Information Theory –Error Free Compression– Lossy Compression.

UNIT II TEXT COMPRESSION

Huffman coding –Adaptive Huffman coding –Arithmetic coding –Shannon-Fano coding – Dictionary techniques –LZW family algorithms.

UNIT III IMAGE COMPRESSION

Image Compression: Fundamentals —Compression Standards –JPEG Standard –Sub-band coding– Wavelet Based compression –Implementation using Filters –EZW, SPIHT coders –JPEG 2000standards –JBIG and JBIG2 standards.

UNIT IV AUDIO COMPRESSION

Audio compression Techniques –law, A-Law companding –Frequency domain and filtering – Basic sub-band coding –Application to speech coding –G.722 –MPEG audio –progressive encoding – Silence compression, Speech compression –Formant and CELP vocoders.

UNIT V VIDEO COMPRESSION

Video compression techniques and Standards –MPEG video coding: MPEG-1 and MPEG-2 video coding: MPEG-3 and MPEG-4 –Motion estimation and compensation techniques –H.261 Standard– DVI technology –DVI real time compression –Current Trends in Compression standards.

Total: 45 periods

COURSE OUTCOMES

At the end of the course the students are able to

CO1: Implement basic compression algorithms with MATLAB and its equivalent open source environments.

CO2: Design and implement some basic compression standards

CO3: Critically analyze different approaches of compression algorithms in multimedia related mini projects.

REFERENCES:

1. David Solomon, "Data Compression –The Complete Reference", Fourth Edition, Springer Verlog, New York, 2006.
2. Darrel Hankerson, Greg A Harris, Peter D Johnson, „Introduction to Information Theory andData Compression,Second Edition, Chapman and Hall ,CRC press, 2003.
3. Khalid Sayood: Introduction to Data Compression", Morgan Kauffman Harcourt India, ThirdEdition, 2010.
4. Mark S. Drew, Ze-Nian Li, "Fundamentals of Multimedia", PHI, 2009.
5. Peter Symes : Digital Video Compression, McGraw Hill Pub., 2004.
6. Yun Q.Shi, Huifang Sun, "Image and Video Compression for Multimedia Engineering, Algorithms and Fundamentals", CRC Press, 2003.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Implement basic compression algorithms with MATLAB and its equivalent open sourceenvironments	3							3						
CO2	Design and implement some basic compression standards	3	2				3								
CO3	Critically analyze different approaches of compression algorithms in multimedia related mini projects	3		3			3								

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		L	T	P	C
18MCE03	SOFTWARE TESTING AND QUALITYASSURANCE	3	0	0	3

COURSE OBJECTIVES

- Describe approaches to quality assurance
- Understand quality models
- Evaluate the system based on the chosen quality model

UNIT I INTRODUCTION 9

Introduction – Views on quality – Cost of quality - Quality models – Quality frameworks – Verification and Validation – Defect taxonomy – Defect management – Statistics andmeasurements – IEEE standards – Quality assurance and control processes

UNIT II VERIFICATION 9

Introduction – Verification techniques – Inspections, reviews, walk-throughs – Case studie

UNIT III TEST GENERATION 9

Software testing- Validation – Test plan – Test cases - Test Generation – Equivalence partitioning – Boundary value analysis – Category partition method – Combinatorial generation -Decisiontables – Examples and Case studies

UNIT IV STRUCTURAL TESTING 9

Introduction – Test adequacy criteria – Control flow graph – Coverages: block, conditions, multiple conditions, MC/DC, path – Data flow graph – Definition and use coverages – C-use, P- use, Def- clear, Def-use – Finite state machines – Transition coverage – Fault based testing – Mutation analysis – Case studies

UNIT V FUNCTIONAL TESTING 9

Introduction – Test adequacy criteria - Test cases from use cases – Exploratory testing - Integration, system, acceptance, regression testing – Testing for specific attributes: Performance, load and stress testing – Usability testing – Security testing - Test automation – Test oracles

Total: 45 periods

COURSE OUTCOMES

At the end of the course the students are able to

CO 1: Describe different approaches to testing software applications
CO 2: Analyze specifications and identify appropriate test generation strategies
CO 3: Develop an appropriate test design for a given test object
CO 4: Identify applicable measurements for the verification and validation effort
CO 5: Execute the test design
CO 6: Evaluate the testing effort based on adequatemeasures

REFERENCES:

1. BorizBeizer, "Software Testing Techniques", 2nd Edition, DreamTech, 2009.

2. Aditya P. Mathur, "Foundations of Software Testing", Pearson, 2008.
3. Mauro Pezze and Michal Young, "Software Testing and Analysis, Process, Principles, and Techniques", John Wiley 2008.
4. Stephen H. Kan, "Metrics and Models in Software Quality Engineering", 2nd Edition,Pearson, 2003.
5. KshirasagarNaik and PriyadarshiTripathy (Eds), "Software Testing and Quality Assurance: Theory and Practice", John Wiley, 2008.
6. "Combinatorial Methods in Software Testing", tp://csrc.nist.gov/groups/SNS/acts/index.html.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Describe different approaches to testing software applications	3				3									
CO2	Analyze specifications and identify appropriate test generation strategies	3	2			3									
CO3	Develop an appropriate test design for a given test object.	3					3								
CO4	Identify applicable measurements for the verification and validation effort.	3						1							
CO5	Execute the test design	3		3				1	2	1					
CO6	Evaluate the testing effort based on adequatemeasures	3						1							

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218MCE04	SOCIAL NETWORK MINING AND ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand the concept of semantic web and related applications.
- Learn knowledge representation using ontology.
- Understand human behaviour in social web and related communities
- Learn visualization of social networks.

UNIT I: INTRODUCTION 9

Introduction to Semantic Web: Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Social Network analysis: Development of Social Network Analysis – Key concepts and measures in network analysis – Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities – Web-based networks –Applications of Social Network Analysis.

UNIT II: MODELLING, AGGREGATING AND KNOWLEDGEREPRESENTATION 9

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation – Ontology languages for the Semantic Web: Resource Description Framework – Web Ontology Language – Modelling and aggregating social network data: State-of-the-art in network data representation – Ontological representation of social individuals – Ontological representation of social relationships – Aggregating and reasoning with social network data – Advanced representations.

UNIT III: EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS 9

Extracting evolution of Web Community from a Series of Web Archive – Detecting communitiesin social networks – Definition of community – Evaluating communities – Methods for communitydetection and mining – Applications of community mining algorithms – Tools for detecting communities social network infrastructures and communities – Decentralized online social networks – Multi-Relational characterization of dynamic social network communities.

UNIT IV: PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES 9

Understanding and predicting human behaviour 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 basedon 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 – Matrix and Node-Link Diagrams – Hybrid representations – Applications – Cover networks – Community welfare – Collaboration networks – Co-Citation networks.

Total: 45 periods

COURSE OUTCOMES

At the end of the course the students are able to

CO 1: Develop semantic web related applications.

CO 2: Represent knowledge using ontology.

CO 3: Predict human behaviour in social web and related communities.

CO 4: Visualize social networks.

REFERENCE BOOKS:

1. Peter Mika, "Social Networks and the Semantic Web", , First Edition, Springer 2007.
2. Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010.
3. Guandong Xu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking –Techniques and applications", First Edition Springer, 2011.
4. Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet,2008.
5. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2009.
6. John G. Breslin, Alexandre Passant and Stefan Decker, "The Social Semantic Web",Springer, 2009.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Develop semantic web related applications	3					3								
CO2	Represent knowledge using ontology.	3	2		3										
CO3	Predict human behaviour in social web and related communities.	3								1					
CO4	Visualize social networks.	3		3										1	

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218MCE05	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the concepts of virtualization and virtual machines
- To gain expertise in server, network and storage virtualization.
- To understand and deploy practical virtualization solutions and enterprise solutions
- To gain knowledge on the concept of virtualization that is fundamental to cloudcomputing
- To understand the various issues in cloud computing
- To be able to set up a private cloud
- To understand the security issues in the grid and the cloud environment

UNIT I VIRTUALIZATION 9

Basics of Virtual Machines -Process Virtual Machines –System Virtual Machines –Emulation – Interpretation –Binary Translation -Taxonomy of Virtual Machines. Virtualization –Management Virtualization —Hardware Maximization –Architectures –Virtualization Management –Storage Virtualization –Network Virtualization

UNIT II VIRTUALIZATION INFRASTRUCTURE 9

Comprehensive Analysis –Resource Pool –Testing Environment –Server Virtualization – VirtualWorkloads –Provision Virtual Machines –Desktop Virtualization –ApplicationVirtualization - Implementation levels of virtualization –virtualization structure –virtualization of CPU, Memory and I/O devices –virtual clusters and Resource Management –Virtualization for data center automation.

UNIT III CLOUD PLATFORM ARCHITECTURE 9

Cloud deployment models: public, private, hybrid, community –Categories of cloud computing: Everything as a service: Infrastructure, platform, software-A Generic Cloud Architecture Design– Layered cloud Architectural Development –Virtualization Support and Disaster Recovery – Architectural Design Challenges -Public Cloud Platforms : GAE,AWS –Inter-cloud Resource Management

UNIT IV PROGRAMMING MODEL 9

Introduction to Hadoop Framework -Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job –Developing Map Reduce Applications - Design of Hadoop file system –Setting up Hadoop Cluster -Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack, Nimbus

UNIT V CLOUD SECURITY 9

Cloud Infrastructure security: network, host and application level –aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud -Key privacy issues in the cloud –Cloud Security and Trust Management

Total: 45 periods

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COURSE OUTCOMES

At the end of the course the students are able to

CO1: Employ the concepts of storage virtualization, network virtualization and its management

CO2: Apply the concept of virtualization in the cloud computing

CO3: Identify the architecture, infrastructure and delivery models of cloud computing

CO4: Develop services using Cloud computing

CO5: Apply the security models in the cloud environment

REFERENCE BOOKS:

1. Danielle Ruest, Nelson Ruest, —Virtualization: A Beginners Guide McGraw-Hill Osborne Media, 2009.
2. Jim Smith, Ravi Nair , "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
3. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management,and Security", CRC Press, 2010.
4. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
5. Tim Mather, Subra Kumaraswamy, and Shahed Latif ,"Cloud Security and Privacy",O'Reilly Media, Inc.,2009.
6. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.
7. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Employ the concepts of storage virtualization, network virtualization and its management	3			3									1	
CO2	Recognize and develop sophisticated queries and authorization techniques to extract information from database	3	2				3								
CO3	Identify the architecture, infrastructure and delivery models of cloud computing	3						2							
CO4	Develop services using Cloud computing	3						2						1	
CO5	Apply the security models in the cloud environment			3										1	

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315MCT01 INFORMATION SECURITY

L T P C
3 0 0 3

PREREQUISITES: NIL

OBJECTIVES:

- To understand the basics and need for Information security
- To understand the issues , identify Risk, asses and control it in Information security
- Determine IT security guidelines for various type of industries
- To design security applications in the field of Information technology

UNIT I – INTRODUCTION & NEED FOR SECUTIRY 9

Introduction to Information Security, Critical Characteristics of Information, CNSS Security Model, The SDLC, The SSDLC, Threats ,Attacks .

UNIT II - LEGAL, ETHICAL, AND PROFESSIONAL ISSUES IN INFORMATION SECURITY 9

Law and Ethics in Information Security , International Laws and Legal Bodies-Ethics and Information Security, Codes of Ethics and Professional Organizations .

UNIT III- RISK MANAGEMENT & SECURITY PLANNING 9

Risk Identification- Risk Assessment- Risk Control Strategies, Information Security Planning and Governance, Information Security Policy, Standards, and Practices, The Information Security Blueprint.

UNIT IV- PHYSICAL SECURITY 8

Introduction- Physical Security Controls- Fire Security and Safety- Failure of Supporting Utilities and Structural Collapse- Mobile and Portable System.

UNIT V- PHYSICAL DESIGN AND IMPLEMENTATION 10

Security Technology, IDS, Honey Pots, Honey Nets, and Padded Cell Systems, Scanning and Analysis Tools, Implementing Information Security, Project Management for Information Security, Technical Topics of Implementation, Nontechnical Aspects of Implementation.

TOTAL HOURS: 45

REFERENCES:

1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Thomson (Cengage) Indian 4th Edition.2011
2. V k Pachghare: Cryptography and Information Security, PHE ,2013
3. Matt Bishop, "Computer Security Art and Science", Pearson/PHI, 2005.
4. Micki Krause, Harold F. Tipton, "Handbook of Information Security Management", Vol 1-3 CRC Press

Course Outcomes

Upon completion of this course, the student should be able to

CO1 :Analyze the vulnerabilities in any computing system and hence be able to design a security solution.

CO2:Identify the concepts ,policies associated with security.

CO3:Analyze the possible security attacks in real time systems and their effective countermeasures

CO4:Formulate research problems in the computer security field

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315MCT01 **RESEARCH METHODOLOGY**

L	T	P	C
3	0	0	3

Course Objectives

- To make students aware of how literature reviews can help in problem formulation and definition.
- To develop student skills in Research design
- To develop student skills in designing and executing hypothesis tests
- To develop the student skills in structured presentation of research findings using oral and written reports.

UNIT I: Research Problem and Methods of Data Collection 9

Research methodology – definition, mathematical tools for analysis, Types of research, exploratory research, conclusive research, modeling research, algorithmic research, Research process- steps. Data collection methods- Primary data – observation method, personal interview, telephonic interview, mail survey, questionnaire design. Secondary data- internal sources of data, external sources of data.

UNIT II: Measurement, Scaling Techniques and Sampling 9

Scales – measurement, Types of scale – Thurstone's Case V scale model, Osgood's Semantic Differential scale, Likert scale, Q- sort scale. Sampling methods- Probability sampling methods – simple random sampling with replacement, simple random sampling without replacement, stratified sampling, cluster sampling. Non-probability sampling method – convenience sampling, judgment sampling, quota sampling.

UNIT III: Hypotheses testing 9

Introduction – Testing of hypotheses concerning means (one mean and difference between two means -one tailed and two tailed tests), Concerning variance – one tailed Chi-square test.

UNIT IV: Nonparametric tests 9

Introduction - One sample tests – one sample sign test, Kolmogorov- Smirnov test, run test for randomness, Two sample tests – Two sample sign test, Mann- Whitney U test, K-sample test – Kruskal Wallis test (H-Test)

UNIT V: Analysis of Data and Report Writing 9

Introduction to Disciminant analysis, Factor analysis, cluster analysis, multidimensional scaling, conjoint analysis. Report writing- Types of report, guidelines to review report, typing instructions, oral presentation

REFERENCES

1. Kothari, C.R., Research Methodology –Methods and techniques,.3/e, ,New Age International Publishers Ltd New Delhi, 2014

2. Panneerselvam, R., Research Methodology, Prentice-Hall of India, New Delhi, 2007

Course Outcomes

Upon completion of this course, the student should be able to:

CO1: The student will be able to define a research problem and hypothesis based on literature review

CO2: The student will be able to device a suitable Research Design for data collection

CO3: The student will be able to formulate and test hypothesis

CO4: The student will be able to report the findings in a structured manner.

315MCE02 **MACHINE LEARNING**

L	T	P	C
3	0	0	3

PREREQUISITES:

- Probability and statistics
- Graph theory

OBJECTIVES:

- To understand the concepts of machine learning
- To appreciate supervised and unsupervised learning and their applications
- To understand the theoretical and practical aspects of Probabilistic Graphical Models
- To appreciate the concepts and algorithms of reinforcement learning

UNIT I **INTRODUCTION** **9**

Learning – Design of a Learning system - Types of machine learning –Applications Probability Theory -Probability densities Expectations and covariance -Bayesian probabilities - Gaussian distribution-Curve fitting re-visited -Bayesian curve fitting – Probability distributions -Decision Theory-Bayes Decision Theory - Information Theory

UNIT II **SUPERVISED LEARNING** **9**

Linear Models for Regression - Linear Basis Function Models - Predictive distribution Equivalent kernel-Bayesian Model Comparison-Evidence Approximation - Effective number of parameters - Limitations of Fixed Basis Functions - Linear Models for Classification – Naïve Bayes - Discriminate Functions - Probabilistic Generative Models -Probabilistic Discriminative Models - Bayesian Logistic Regression. Neural Networks Feed-forward Network Functions - Back- propagation.

UNIT III **UNSUPERVISED LEARNING** **9**

Clustering- K-means - EM Algorithm- Mixtures of Gaussians. Supervised Learning after Clustering Hierarchical Clustering Choosing the Number of Clusters The Curse of Dimensionality Reduction - Factor analysis - Principal Component Analysis - Probabilistic PCA- Independent components analysis

UNIT IV PROBABILISTIC GRAPHICAL MODELS 9

Graphical Models - Undirected graphical models - Markov Random Fields - Directed Graphical Models - Bayesian Networks - Conditional independence properties - Inference – Learning- Generalization - Hidden Markov Models - Conditional random fields(CRFs)

UNIT V REINFORCEMENT LEARNING 9

Reinforcement Learning- Introduction Single State Case: K-Armed Bandit - Elements of Reinforcement Learning - Model-Based Learning - Value Iteration - Policy Iteration - Temporal Difference Learning - Exploration Strategies - Deterministic Rewards and Actions - Nondeterministic Rewards and Actions - Eligibility Traces - Generalization Partially Observable States - The Setting - The Tiger Problem

TOTAL: 45

REFERENCES

1. Ethem Alpaydin, "Introduction to Machine Learning", Prentice Hall of India, 2014
2. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2006
3. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012
4. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.
5. Hastie, Tibshirani, Friedman, "The Elements of Statistical Learning" (2nd ed)., Springer, 2008
6. Stephen Marsland, "Machine Learning –An Algorithmic Perspective", CRC Press, 2009

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

CO1:To implement a neural network for an application of your choice using an available tool

C02:To implement probabilistic discriminative and generative algorithms for an application of your choice and analyze the results

CO3:To use a tool to implement typical clustering algorithms for different types of applications

CO4:To design and implement an HMM for a sequence model type of application

315MCE03 Wireless Sensor Network

L	T	P	C
3	0	0	3

PREREQUISITE: COMPUTER NETWORKS

OBJECTIVES:

- To understand the basic WSN technology.
- To study the sensor architecture and operating system.
- To learn the key routing protocols for sensor network.
- To learn to develop applications in wireless sensor network.

UNIT I INTRODUCTION AND OVERVIEW OF WIRELESS SENSOR NETWORKS 9

Background of Sensor Network Technology, Application of Sensor Networks, Challenges for Wireless Sensor Networks, Sensor Node Technology, Hardware and Software, Sensor Taxonomy, WN Trends.

UNIT II OPERATING SYSTEM AND ARCHITECTURE 9

Single-node Architecture, Hardware Components & Design Constraints, Operating Systems and Execution Environments, Case study: TinyOS and nesC.
Network Architecture: Sensor Network Scenarios, Design Principles for WSNs, Service Interfaces of WSNs, Gateway Concepts.

UNIT III ROUTING PROTOCOLS AND DATA MANIPULATION 9

Issues in Designing Routing Protocols, Routing Strategies in Wireless Sensor Networks, Energy-Efficient Routing, Unicast, Broadcast and Multicast, Geographic Routing. Data Centric and Content based Routing, Storage and Retrieval in Network, Compression Technologies for WSN, Data Aggregation Technique.

UNIT IV SENSOR NETWORK PLATFORMS AND TOOLS 9

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level Software Platforms, Node-level Simulators, State-centric Programming.

UNIT V SECURITY AND APPLICATIONS OF WIRELESS SENSOR NETWORK 9

Overview of Wireless Sensor Network Security, Vulnerabilities and Attacks in Wireless Sensor Networks, Secure Routing in Wireless Sensor Networks, Applications: Artificial Eye Vision Using Wireless Sensor Networks, Wireless Sensor Networks: A Medical Perspective.

TOTAL HOURS: 45

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REFERENCES:

1. Ibrahiem M. M. El Emary, S. Ramakrishnan, "Wireless Sensor Networks: From Theory to Applications" CRC Press, 2013. (UNIT-V)
2. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005. (UNIT–II & III)
3. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007. (UNIT-IV)
4. Raghavendra, Cauligi S, Sivalingam, Krishna M., Zanti Taieb, "Wireless Sensor Network", Springer, First Ed. 2004 (ISBN: 978-4020-7883-5). (UNIT-III)
5. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007. (UNIT-I)
6. Javier Lopez, J Zhou, "Wireless Sensor Network Security", IOS press, 2008. (UNIT-V)
7. Rainer Matischek, "A TinyOS - Based Ad Hoc Wireless Sensor Network: Introduction, Versatile Application Design", Implementation, VDM Verlag, 2008. (UNIT-II)

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

- Understand sensor characteristics.
- Analyze the role of sensors in Wireless networks.
- Gain the knowledge in routing protocol for WSN.
- Understand the basic architecture for WSN based applications.

315MCE04 **UNIX INTERNALS**

L	T	P	C
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PREREQUISITES: Operating System and C Programming

OBJECTIVES:

- To get through understanding of the kernel.
- To understand the file organization and management.
- To know the various system calls.
- To have knowledge of process architecture, process control & scheduling and memory management.

UNIT I **OVERVIEW** **9**

General Overview of the System: System structure – User perspective – Operating system services – Assumptions about hardware – Architecture of the UNIX operating system – Introduction to system concepts – The Buffer Cache: Buffer headers – Structure of the buffer pool – Scenarios for retrieval of a buffer – Reading and writing disk blocks – Advantages and disadvantages of the buffer cache.

UNIT II **FILE SYSTEM** **9**

Internal representation of files: inodes – Structure of a regular file – Distributed File System Architecture – Characteristics – Remote File Sharing Architecture– RFS Implementation –Andrew File System – AFS Implementation.

UNIT III **THE PROCESS** **9**

Process Control: Process creation – Process termination – Awaiting process termination – Invoking other programs – User id of a process – Changing the size of a process– Process states and transitions – Process Scheduling – SV4 Scheduler – Scheduling in Mach.

UNIT IV **THREADS AND SIGNALS** **9**

Thread – Kernel Thread –User Thread – Lightweight Process Design – Multithreading in Solaris and SVR4 – Signal – Signal Generation – Signal Handling – Unreliable Signal – Reliable Signal – Signal Implementation.

UNIT V **MEMORY MANAGEMENT AND I/O** **9**

Memory Management Policies: Swapping – Demand paging – Memory Management Design – Page Replacement – The I/O Subsystem – Driver Interface – Disk Driver Framework – Terminal Drivers.

TOTAL HOURS: 45

REFERENCES

1. Uresh Vahalia, "Unix Internals: The New Frontiers", Pearson Education, 2008.

2. J.Maurice Bach,"The Design of the Unix Operating System",First Edition,Pearson Education, 2006.

3. B.Goodheart and J.Cox, "The Magic Garden Explained", Prentice Hall of India, 1994.

4. S.J.Leffler, Mckusick M.K.Karels M.J and J.S Quarterman., "The Design and Implementation of the 4.3 BSD Unix Operating System", Addison Wesley, 1998.

5. Behrouz A. Forouzan, Richard Gilberg, "Unix & Shell programming", Thomson Asia, 2003.

OUTCOMES:

Upon completion of the course, the students will be able to

CO1: Understand the basic functioning of UNIX operating systems and shell programming.

CO2: Analyze the buffer representation, kernels and system calls.

CO3: Understand the system structure, implementation of system calls.

CO4: Learn the UNIX segmentation, paging and scheduling the Drivers and IPC.

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315MCE05 BIG DATA ANALYTICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- Understand big data for business intelligence
- Learn business case studies for big data analytics
- Understand nosql big data management
- Perform map-reduce analytics using Hadoop and related tools

UNIT-I UNDERSTANDING BIGDATA 9

What is big data – why big data – convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine – advertising and big data – big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics

UNIT-II NOSQL DATA MANAGEMENT 9

Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schemaless databases – materialized views – distribution models – sharding – master-slave replication – peer-peer replication – sharding and replication – consistency – relaxing consistency – version stamps – map-reduce – partitioning and combining – composing map-reduce calculations

UNIT-III BASICS OF HADOOP 9

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures

UNIT-IV MAP REDUCE APPLICATIONS 9

MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats

UNIT-V HADOOP RELATED TOOLS 9

Hbase – data model and implementations – Hbase clients – Hbase examples – praxis.Cassandra – cassandra data model – cassandra examples – cassandra clients – Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts.

TOTAL HOURS : 45

REFERENCES:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
3. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
4. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
5. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
6. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
7. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
8. Alan Gates, "Programming Pig", O'Reilley, 2011.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

CO1:Describe big data and use cases from selected business domains
CO2:Explain NoSQL big data management
CO3:Install, configure, and run Hadoop and HDFS
CO4:Perform map-reduce analytics using Hadoop
CO5:Use Hadoop related tools such as HBase, Cassandra, Pig, for big data analytics

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315MCE06 BIO-INFORMATICS

L	T	P	C
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PREREQUISITES: NIL.

OBJECTIVES:

- To understand the basic concepts.
- To search information, visualize it.
- To learn various bioinformatics algorithms.
- To understand data mining techniques.
- To study various pattern matching techniques

UNIT I – INTRODUCTORY CONCEPTS **9**

The Central Dogma – The Killer Application – Parallel Universes – Watson's Definition – Top DownVersus Bottom up – Information Flow – Convergence – Databases – Data Management – Data LifeCycle – Database Technology – Interfaces – Implementation – Networks – Geographical Scope –Communication Models – Transmissions Technology – Protocols – Bandwidth – Topology – Hardware – Contents – Security – Ownership – Implementation – Management.

UNIT II - SEARCH ENGINES, VISUALIZATION AND ALGORITHMS **9**

The search process – Search Engine Technology – Searching and Information Theory – Computational methods – Search Engines and Knowledge Management – Data Visualization – sequence visualization – structure visualization – user Interface –Animation Versus simulation – General Purpose Technologies - Exhaustive search – Greedy – Dynamic programming – divide andconquer – graph algorithms

UNIT III STATISTICS AND DATA MINING **9**

Statistical concepts – Microarrays – Imperfect Data – Randomness – Variability – Approximation –Interface Noise – Assumptions – Sampling and Distributions – Hypothesis Testing – QuantifyingRandomness – Data Analysis – Tool selectionstatistics of Alignment – Clustering and Classification –Data Mining – Methods – Selection and Sampling – Preprocessing and Cleaning – Transformation andReduction – Data Mining Methods – Evaluation – Visualization – Designing new queries – Pattern Recognition and Discovery – Machine Learning – Text Mining – Tools.

UNIT IV PATTERN MATCHING **9**

Pairwise sequence alignment – Local versus global alignment – Multiple sequence alignment – Computational methods – Dot Matrix analysis – Substitution matrices –Dynamic Programming – Wordmethods – Bayesian methods – Multiple sequence alignment – Dynamic Programming – Progressivestrategies – Iterative strategies –Tools – Nucleotide Pattern Matching – Polypeptide pattern matching– Utilities –Sequence Databases.

UNIT V MODELING AND SIMULATION **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 Periods

REFERENCES:

1. Bryan Bergeron, "Bio Informatics Computing", Second Edition, Pearson Education, 2003.
2. T.K.Attwood and D.J. Perry Smith, "Introduction to Bio Informatics, Longman Essen,1999.
3. An Introduction to, Bioinformatics Algorithms (Computational Molecular Biology) , "Neil C.Jones,PaveA. Pevzner", MIT Press 2004.

COURSE OUTCOMES:

At the end of the course the student will be able to
CO1: Will able to have basic idea of BioInformatics.
CO2:Will able to retrieve information's using various algorithms and techniques.
CO3:Will able to sequence the databases.
CO4: Will able to do modeling and simulation

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315MCE07 SOFTWARE TESTING AND QUALITY ASSURANCE

L	T	P	C
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PREREQUISITES: Software Engineering, Object oriented Analysis and Design, Object Oriented software Engineering.

OBJECTIVES:

- To introduce the basics and necessity of software testing.
- To introduce various testing techniques along with software production.
- To introduce the concepts of Software quality and its assurance.

UNIT I - INTRODUCTION **9**

Basics of Software Testing – Testing Principles – Goals – Testing Life Cycle– Phases of Testing–Test Plan(IEEE format) – Importance of Testing in Software Production Cycle- Software Test Plan–Components of Plan - Types of Technical Reviews - Static and Dynamic Testing.

UNIT II - SOFTWARE TESTING METHODOLOGY & STRATEGIES **9**

Software Testing in Spiral Manner - Information Gathering - Test Planning - Test Case Design - Test Development - Test Coverage - Test Evaluation -Prepare for Next Spiral - Conduct System Test - Acceptance Test - Summarize Testing Results. Testing strategies – white box and black box approach – integration testing – system and acceptance testing – performance testing – regression testing - internationalization testing – ad-hoc testing – website testing – usability testing – accessibility testing Test plan – management – execution and reporting – software test automation – automated testing tools.

UNIT III - EMERGING SPECIALIZED AREAS IN TESTING **9**

Test Process Assessment – Test Automation Assessment - Test Automation Framework – Nonfunctional Testing – SOA Testing – Agile Testing – Testing Center of Excellence – Onsite/Offshore Model - Modern Software Testing Tools. Manual testing, Automated Testing Tools & Case studies, Study of Testing tools (Selenium, QTP, Rational Robot, Winrunner, Loadrunner, JMeter).

UNIT IV- SOFTWARE QUALITY **9**

Hierarchical models of software quality – software quality metrics –function points -Software product quality – software maintenance quality – effect of case tools – software quality infrastructure – procedures – certifications – configuration management – documentation control. SQA Plan – Quality Standards – CMM – PCMM – CMMI – Malcolm Baldrige National Quality Award.

UNIT V- QUALITY ASSURANCE **9**

Quality management -Quality assurance plan-SCM support functions-SCM Tools-Establishing standards – Guidelines-Basic inspection principles-Principles of software defect prevention-Process changes for defect prevention -Defect prevention considerations. Configuration accounting and audit.

TOTAL: 45 Hours

REFERENCES:

1. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rdEdition, Auerbach Publications, 2012.
2. Watts S. Humphrey, Managing the software process, Addison Wesley, 2011
3. Brian Marrick: The Craft of Software Testing, 1st edition,Pearson, 2012.
4. Srinivasan Desikan, Gopalaswamy Ramesh: Software testing Principles and Practices, 1stEdition, Pearson, 2012.
5. Kshirasagar Naik, Priyadarshi Tripathy, "Software Testing and Quality Assurance Theory and Practice", John Wiley & Sons publication, 2011.
6. Yogesh Singh, "Software Testing", Cambridge University Press, 2012.
7. William E.Lewis, "Software Testing and Continuous Quality Improvement", Third edition, Auerbach Publications, 2011.
8. Mauro Pezze, Michal Young: Software Testing and Analysis –Process, Principles and Techniques, 1st edition, John Wiley & Sons, 2011.

COURSE OUTCOMES:

At the end of the course the student will be able to
CO1: To work with various software testing strategies.
CO2: To use various testing methods for the appropriate applications.
CO3: To design and develop software quality models and implements software quality assurance.
CO4: To assess Quality Assurance standards and tools.

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315MCE08 NATURAL LANGUAGE PROCESSING

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OBJECTIVES:

- To understand the representation and processing of Morphology and Part-of Speech Taggers
- To appreciate various techniques used for speech synthesis and recognition
- To understand different aspects of natural language syntax and the various methods used for processing syntax and disambiguating word senses
- To appreciate the various representations of semantics and discourse
- To know about various applications of natural language processing

UNIT - I MORPHOLOGY AND PART-OF SPEECH PROCESSING 9

Introduction –Regular Expressions and Automata- Non-Deterministic FSAs. Tranducers –English Morphology - Finite-State Morphological Parsing - Porter Stemmer - Tokenization- Detection and Correction of Spelling Errors. N-grams – Perplexity - Smoothing - Interpolation - Backoff . Part-of- Speech Tagging – English Word Classes - Tagsets - Rule-Based - HMM - Transformation-Based Tagging - Evaluation and Error Analysis. Hidden Markov and Maximum Entropy Models

UNIT - II SPEECH PROCESSING 9

Phonetics – Articulatory Phonetics - Phonological Categories - Acoustic Phonetics and Signals - Speech Synthesis – Text Normalization – Phonetic and Acoustic Analysis - Diphone Waveform synthesis – Evaluation- Automatic Speech Recognition –Architecture - Hidden Markov Model to Speech - MFCC vectors - Acoustic Likelihood Computation - Evaluation. Triphones – Discriminative Training - Modeling Variation. Computational Phonology-Finite-State Phonology – Computational Optimality Theory - Syllabification - Learning Phonology and Morphology

UNIT - III SYNTAX ANALYSIS 9

Formal Grammars of English – Constituency - Context-Free Grammars –Grammar Rules – Treebanks - Finite-State and Context-Free Grammars - Dependency Grammars. Syntactic Parsing – Parsing as Search - Ambiguity - Dynamic Programming Parsing Methods –CKY- Earley and Chart Parsing- Partial Parsing- Evaluation. Statistical Parsing – Probabilistic Context-Free Grammars – Probabilistic CKY Parsing of PCFGs – Probabilistic Lexicalized CFGs –Collins Parser. Language and Complexity -The Chomsky Hierarchy -The Pumping Lemma

UNIT - IV SEMANTIC AND PRAGMATIC INTERPRETATION 9

Representation of Meaning – Desirable Properties - Computational Semantics -Word Senses - Relations Between Senses – WorldNet - Event Participants- Proposition Bank -Frame Net -– Metaphor. Computational Lexical Semantics – Word Sense Disambiguation- Supervised Word Sense Disambiguation – Dictionary and Thesaurus Methods- Word Similarity - Minimally Supervised WSD - Hyponymy and Other Word Relations Semantic Role Labeling -Unsupervised Sense Disambiguation. Computational Discourse - Discourse Segmentation - Unsupervised Discourse - Segmentation - Text Coherence - Reference Resolution –Phenomena – Features and algorithms - Pronominal Anaphora Resolution

UNIT - V APPLICATIONS

Information Extraction – Named Entity Recognition - Relation Detection and Classification –Temporal and Event Processing - Template-Filling - Biomedical Information Extraction. Question Answering and Summarization -Information Retrieval -Factoid Question Answering - Summarization - Single and Multi-Document Summarization - Focused Summarization - Evaluation. Dialog and Conversational Agents – Properties of Human Conversations - Basic Dialogue Systems - VoiceXML - Information- State and Dialogue Acts - Markov Decision Process Architecture. Machine Translation –Issues in Machine Translation - Classical MT and the Vauquois Triangle -Statistical MT - Phrase-Based Translation Model - Alignment in MT –IBM Models –Evaluation

Total Hours: 45

REFERENCES:

1.Jurafsky and Martin, "Speech and Language Processing", Pearson Prentice Hall, Second Edition, 2008.
2. Christopher D. Manning and Hinrich Schütze, "Foundations of Statistical Natural Language Processing", MIT Press, 1999.
3. Stevan Bird, "Natural Language Processing with Python", Shroff, 2009.
4. James Allen, "Natural Language Understanding", Addison Wesley, Second Edition, 2007.
5. Nitin Indurkhya, Fred J. Damerau, "Handbook of Natural Language Processing", (Chapman & Hall/CRC Machine Learning & Pattern Recognition), Second Edition, 2010.
6. Alexander Clark, Chris Fox, Shalom Lappin, "The Handbook of Computational Linguistics and Natural Language Processing", Wiley-Blackwell, 2012.

COURSE OUTCOMES:

Upon completion of this course, the student should be able to:

CO1: Identify the different linguistic components of given sentences
CO2:Design a morphological analyser for a language of your choice using finite state automata concepts
CO3:Implement the Earley algorithm for a language of your choice by providing suitable grammar and words
CO4:Use a machine learning algorithm for word sense disambiguation
CO5:Build a tagger to semantically tag words using Word Net
CO6: Design a business application that uses different aspects of language processing

315MCE09 INFORMATION RETRIEVAL

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Prerequisites: Data warehousing and Data Mining.

OBJECTIVES:

- To understand the basics of information retrieval with pertinence to modeling, query operations and indexing
- To get an understanding of machine learning techniques for text classification and clustering.
- To understand the various applications of information retrieval giving emphasis to multimedia IR, web search
- To understand the concepts of digital libraries

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 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 CLASSIFICATION AND CLUSTERING 9

Text Classification and Naïve Bayes – Vector Space Classification – Support vector machines and Machine learning on documents. Flat Clustering – Hierarchical Clustering –Matrix decompositions and latent semantic indexing – Fusion and Meta learning.

UNIT V USER INTERFACE AND SEARCHING THE WEB 9

User Interface: Introduction, Human-Computer interaction, The information access process, Starting pints, Query specification, Context, Using relevance judgments, Interface support for the search process. **Searching the Web:** Introduction, Challenges, Characterizing the web, Search engines, Browsing, Metasearchers, Finding the needle in the haystack, Searching using hyperlinks.

Total:45 Periods

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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 Implementing and Evaluating Search Engines", The MIT Press, Cambridge, Massachusetts London, England, 2010.
4.David A. Grossman, Ophir Frieder: Information Retrieval Algorithms and Heuristics, 2nd Edition, Springer, 2009.
5. William B. Frakes, Ricardo Baeza-Yates (Editors): Information Retrieval Data Structures and Algorithms, 1st edition, Prentice Hall PTR, 2009.

Course Outcome: At the end of the course the student will be able to

CO 1: Build an Information Retrieval system using the available tools.
CO 2: Identify and design the various components of an Information Retrieval System.
CO 3: Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval.
CO 4: Design an efficient search engine and analyze the Web content structure.

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315MCE10 **Vehicular Adhoc Networks**

L T P C
3 0 0 3

PREREQUISITES: Wireless Sensor Network, Mobile Adhoc Networks

OBJECTIVES:

- To have a thorough understanding on the basic concepts of VANET.
- To understand VANETs to promote Traffic Safety.
- To gain knowledge on networking, localization of VANET and its simulation tools.
- To recognize VANETs in emerging application of internet, distributed gaming and the fast growing Mobile entertainment industry.

UNIT I INTRODUCTION 9

Traffic Monitoring: Causes of congestion, Traffic Monitoring Data, Common Applications of Traffic Data, Commonly used sensor technology, Detection methods.

UNIT II TRAFFIC ENGINEERING 9

Models for Longitudinal Vehicle Movement, Lane changes situations, simulating Vehicle-to-Vehicle, Infrastructure -to-Vehicle Communication.

UNIT III NETWORKING 9

Mobile Ad Hoc routing in the context of Vehicular Networks: Applicability of MANET Routing to Vehicular environment, Routing protocols for VANET. Delay -Tolerant Networks: Deterministic/Stochastic Delay-Tolerant Routing, Vehicle Traffic Model, Vehicle- Roadside Data Access, Data Dissemination in VANETs.

UNIT IV LOCALIZATION AND SIMULATION 9

Localization-Aware VANET applications, Localization Techniques for VANETs, Data Fusion in VANET Localization Systems, Vehicular Mobility Models, Vehicular Network Simulators.

UNIT V APPLICATIONS 9

Safety related vehicular applications, Emerging vehicular applications, Use of Infrastructure in VANETs, Content delivery in Zero – Infrastructure VANETS.

TOTAL HOURS: 45

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REFERENCES:

1.Stephan Olariu, Michele C. Weigle, "Vehicular Networks from Theory to practice" , CRC Press.
2. Hassnaa Moustafa and Yan Zhang, " Vehicular Networks: Techniques, Standards and Applications ," Auerbach Publications, 2009.
3. C. Siva Ram Murthy and B.S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols," Prentice Hall, 2012.
4. William Stallings, " Wireless Communications and Networks ," Prentice Hall, 2015

COURSE OUTCOMES:

At the End of the Course the Students will be able to,

CO1: Understand the basic concepts of VANET.
CO2: Gain knowledge on traffic and its safety in VANET.
CO3: Get overview of networking, localization techniques and simulation tools used in VANET.
CO4: Students can work in various applications in VANET and address key research challenges.

315MCE11 Real Time Systems

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PREREQUISITES: NIL

OBJECTIVES

- To provide good understanding of Basics concepts in real time systems.
- To provide understanding on basic multi-task scheduling algorithms for periodic, aperiodic ,and sporadic tasks as well as understand the impact of the latter two on scheduling
- Real time programming and Tools
- To expose to real time communications and databases.
- To provide good understanding of Fault tolerance, Reliability.

UNIT-I INTRODUCTION **9**

Real-time systems – Applications – Basic Model – Characteristics – Safety and Reliability – Real Time tasks – Timing Constraints – Modelling Timing Constraints.

UNIT II SCHEDULING REAL-TIME TASKS **9**

Concepts – Types of RT Tasks and their Characteristics – Task Scheduling – Clock-Driven Scheduling – Hybrid Schedulers - Event-Driven Scheduling – EDF Scheduling – RMA – Issues with RMA – Issues in Using RMA in Practical Situations.

UNIT-III PROGRAMMING LANGUAGES AND TOOLS **9**

Desired characteristics based on ADA, Data Typing, Control structures, Packages, Exception handling, Overloading Multitasking, Timing Specifications, Task scheduling, Just in time compilation, Run time Support.

UNIT-IVREAL TIME DATABASES **9**

Real time Databases, Basic Definition, Real time Vs General Purpose Databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency Control Issues, Disk Scheduling Algorithms, Two-phase Approach to improve Predictability, Maintaining Serialization Consistency, Databases for Hard Real Time systems.

UNIT-V RTS DEVELOPMENT METHODOLOGIES AND EVALUATIO TECHNIQUES **9**

Introduction, Yourdon methodology, Requirements definition for Drying oven, Ward and Mellor methodology, Hatley and Pirbhai method for real time software development. **Evaluation Techniques**-Fault types, Fault detection and Containment, Reliability Evaluation Techniques, Obtaining Parameter Values, Reliability Models for Hardware Redundancy.

TOTAL HOURS: 45

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REFERENCE BOOKS:

1. Rajib Mall, "Real-Time Systems: Theory and Practice," Pearson, 2008.
2. C.M. Krishna, Kang G. Shin, "Real-Time Systems", McGraw-Hill International Editions, 1997
3. Stuart Bennett, "Real Time Computer Control-An Introduction",Second edition Perntice Hall PTR, 1994.
4. Krishna and Shin, "Real-Time Systems," Tata McGraw Hill. 1999.
5. Philip.A.Laplante "Real Time System Design and Analysis" PHI , III Edition, April 2004.
6. Jane S Liu "Real Time Systems" Pearson Education 2004
7. KVKK Prasad "Embedded Real Time Systems, Concepts, Design and Programming" Dream Teach 2003
8. R.J.A Buhur, D.L. Bailey, " An Introduction to Real-Time Systems", Prentice-Hall International, 1999.
9. S.T. Allworth and R.N. Zobel, "Introduction to real time software design", Macmillan, II Edition, 1987.

COURSE OUTCOME:

At the end of course the students will be able to

- Understand the basics and importance of real-time systems
- Understand basic multi -task scheduling algorithms for periodic, aperiodic, and sporadic tasks as well as understand the impact of the latter two on scheduling
- Generate a test plan based on requirements specification
- Expose to real time Evaluation Techniques

315MCE12 **MULTI CORE ARCHITECTURE** **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce the students to the recent trends in the field of Computer Architecture and identify performance related parameters.
- To understand the design of the memory hierarchy
- To understand the different multiprocessor issues
- To expose the different types of multicore architectures

UNIT - I FUNDAMENTALS OF COMPUTER DESIGN AND ILP 9

Fundamentals of Computer Design – Measuring and Reporting Performance – Instruction Level Parallelism and its Exploitation – Concepts and Challenges – Limitations of ILP – Multithreading – SMT and CMP Architectures – The Multicore era

UNIT - II MEMORY HIERARCHY DESIGN 9

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

UNIT - III MULTIPROCESSOR ISSUES 9

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

UNIT - IV MULTICORE ARCHITECTURES 9

Homogeneous and Heterogeneous Multi-core Architectures – Intel Multicore Architectures – SUN CMP architecture – IBM Cell Architecture. Introduction to Warehouse-scale computers, Cloud Computing – Architectures and Issues – Case Studies.

UNIT - V VECTOR, SIMD AND GPU ARCHITECTURES 9

Vector Architecture – SIMD Extensions for Multimedia – Graphics Processing Units – Case Studies – GPGPU Computing – Detecting and Enhancing Loop Level Parallelism.

Total Hours: 45

COURSE OUTCOMES:

At the End of the Course the Students will be able to,

CO1: Identify the limitations of ILP and the need for multicore architectures
CO2: Discuss the issues related to multiprocessing and suggest solutions
CO3:Point out the salient features of different multicore architectures and how they exploit parallelism
CO4:Critically analyze the different types of inter connection networks
CO5:Design a memory hierarchy and optimize it

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REFERENCES

1. John L. Hennessey and David A. Patterson, "Computer Architecture – A Quantitative Approach", Morgan Kaufmann / Elsevier, 5th edition, 2012.
2. Darryl Gove, "Multicore Application Programming: For Windows, Linux, and Oracle Solaris", Pearson, 2011.
3. David B. Kirk, Wen-mei W. Hwu, "Programming Massively Parallel Processors", Morgan Kauffman, 2010.
4. Wen– mei W. Hwu, "GPU Computing Gems", Morgan Kaufmann / Elsevier, 2011

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