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, 4thEdition, 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.

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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

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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.

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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.

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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

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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

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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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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		L	T	P	C
218MCT02	SECURITY IN COMPUTING	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	

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 of the 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.

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

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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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318MCT01	MACHINE LEARNING TECHNIQUES	L	T	P	C
		4	0	0	4

PREREQUISITES: Data Mining, Probability and Statistics

COURSE OBJECTIVES

- Understand basic concepts and techniques of Machine Learning.
- Insight of Supervised and Unsupervised Learning.
- Study various Probabilistic Graphical Models of Machine Learning Algorithms.
- Learn Reinforcement and Computational Learning techniques.

UNIT I INTRODUCTION9

Introduction to Machine Learning - Types of Machine learning - Basic Concepts in Machine Learning - Examples of Machine Learning Applications - Linear Models for Regression - Linear Basis Function Models - The Bias-Variance Decomposition - Bayesian Linear Regression - Bayesian Model Comparison.

UNIT IISUPERVISED LEARNING9

Linear Models for Classification: Discriminant Functions - Probabilistic Generative Models - Probabilistic Discriminative Models - Bayesian Logistic Regression. Neural Networks: Feed- forward Network Functions - Error Backpropagation – Regularization in Neural Networks - Mixture Density Networks - Bayesian Neural Networks. Kernel Methods - Dual Representations - Radial Basis Function Networks - Ensemble learning: Boosting - Bagging.

UNIT III UNSUPERVISED LEARNING9

Clustering - K-means - Mixtures of Gaussians - The EM Algorithm in General – Model Selectionfor Latent Variable Models - High-Dimensional Spaces. Dimensionality Reduction: Factor analysis - Principal Component Analysis - Probabilistic PCA - Independent components analysis.

UNIT IV PROBABILISTIC GRAPHICAL MODELS9

Directed Graphical Models: Introduction - Bayesian Networks - Examples – Naive Bayes classifiers - Markov Models – Hidden Markov Models – Inference – Learning - Conditional independence properties of DGMs. Undirected graphical models: Markov random fields - Conditional independence properties - Parameterization of MRFs – Examples of MRF - Learning- Conditional random fields (CRFs) - Structural SVMs.

UNITV ADVANCED LEARNING9

Sampling – Basic Sampling Methods – Monte Carlo. Reinforcement Learning: K-Armed Bandit - Elements of Reinforcement Learning - Model-Based Learning. Temporal Difference Learning - Exploration Strategies - Deterministic and Non-deterministic Rewards and Actions - Eligibility Traces – Generalization - Partially Observable States - The Setting - Example. Computational Learning Theory - Mistake bound analysis, sample complexity analysis, VC dimension. Occam learning - accuracy and confidence boosting.

Total: 45 periods

COURSE OUTCOMES

At the end of the course the students are able to

CO 1: Develop learning models from data.

CO 2: Distinguish and apply supervised algorithm for any given problem.

CO 3: Distinguish and apply unsupervised algorithm for any given problem.

CO 4: Design and implement systems that uses the appropriate graph models and sequence model of machine learning.

CO 5: Modify existing machine learning algorithms to improve classification efficiency.

REFERENCES:

1. EthemAlpaydin, "Introduction to Machine Learning", 2nd Edition, Prentice Hall of India,2010.
2. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
3. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
4. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", CRC Press, 2011.
5. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.
6. Hastie, Tibshirani, Friedman, "The Elements of Statistical Learning", 2nd Edition,Springer, 2008.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Develop learning models from data..	3					3								
CO2	Distinguish and apply supervised algorithm for any given problem.	3				2								1	
CO3	Distinguish and apply unsupervised algorithm for any given problem.	3	2			2						1			
CO4	Design and implement systems that uses the appropriate graph models and sequencemodel of machine learning..	3					3						1		
CO5	Modify existing machine learning algorithms to improve classification efficiency.	3		3			3		2	1				1	

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318MCE01	WIRELESS SENSOR NETWORK	L	T	P	C
		4	0	0	4

COURSE OBJECTIVES

- To understand the basic WSN technology and supporting protocols, with emphasis placed on standardization basic sensor systems and provide a survey of sensor technology.
- Understand the medium access control protocols and address physical layer issues.
- Learn key routing protocols for sensor networks and main design issues.
- Learn transport layer protocols for sensor networks, and design requirements.
- Understand the Localization and Security in WSN

UNIT-I: INTRODUCTION OF WSN 9

Basic concepts of wireless sensor networks - Motivations, Challenges and Constraints, Applications, Node Architecture, Sensor Node Technology, Sensor Taxonomy, Operation Environment and Trends in WSN

UNIT-II: MEDIUM ACCESS CONTROL PROTOCOL FOR WSN 9

Fundamentals of WSN MAC protocol, MAC performance Requirements, MAC protocols for sensor networks – Schedule based and Random Access based, Characteristics of MAC protocols in WSN, Content based and Contention free MAC protocols, Hybrid MAC protocols.

UNIT-III: ROUTING PROTOCOLS FOR WSN 9

Data Dissemination and Gathering, Routing Challenges and Design Issues in WSN, Routing strategies in WSN, Routing Metrics, Flooding and Gossiping, Data-centric routing, Proactive Routing, On-Demand Routing, Hierarchical Routing, Location Routing, QoS based Routing Protocols.

UNIT-IV: TCP PROTOCOL & POWER MANAGEMENT FOR WSN 9

Traditional TCP, Transport Protocol Design Issues, Examples of Existing TCP protocols: CODA, ESRT, RMST, PSFQ, GARUDA, ATP, Problems with TCP, Performance of TCP. Power Management: Local Power Management Aspects, Dynamic Power Management, Conceptual Architecture.

UNIT-V: LOCALIZATION AND SECURITY IN WSN 9

Localization: Ranging Techniques, Range-Based Localization, Range-Free Localization, Event-Driven Localization. Challenges of Security in WSN, Security attacks in WSNs, Security protocols for WSNs.

Total: 45 periods

COURSE OUTCOMES

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

CO 1: Gain knowledge and understanding of basic WSN technology and supportingprotocols and Technology

CO 2: Identify medium access control protocols and address physical layer issues

CO 3: Apply knowledge on routing protocols for sensor networks and solve thedesign issues

CO 4: Analyze transport layer protocols for sensor networks, and designrequirements and challenges

CO 5: Gain the knowledge of Localization and Security in Wireless Sensor Network

REFERENCE BOOKS:

1. Fei Hu and Xiaojun Cao, "Wireless Sensor Networks: Principles and Practice",CRC Press, 2010.
2. Q., Muller and Chen, "Security in Wireless Networks and Systems", Willey,2011

TEXT BOOKS:

1. W. Dargie and C. Poellabauer, Fundamentals of Wireless Sensor Networks-Theory and Practice, Wiley, 2010.
2. K. Sohraby, D. Minoli and TaiebZnati, "Wireless Sensor Networks -Technology,Protocols, and Applications", Wiley Interscience, 2007.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Gain knowledge and understanding of basic WSN technology and supportingprotocols and Technology.	3			3										
CO2	Identify medium access control protocols and address physical layer issues	3	2											1	
CO3	Apply knowledge on routing protocols for sensor networks and solve the design issues	3												1	
CO4	Analyze transport layer protocols for sensor networks, and design requirements and challenges.	3		3					2					1	
CO5	Gain the knowledge of Localization and Security in Wireless Sensor Network	3												1	

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318MCE02	VIDEO PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To learn the basics about the video processing
- To understand about the video streaming and tracking
- To be aware of the quality of the videos and surveillance
- Have the ability to carry out research in image sequence related areas

UNIT 1- INTRODUCTION AND VIDEO SAMPLING ESTIMATION 9

Sampled Video-Video Transmission-Objectives and Organization-Video Sampling and Interpolation:-Spatiotemporal Sampling Structures-Sampling and Reconstruction of Continuous Time Varying Imagery-Sampling Structure Conversion-Motion Detection and Estimation:- Notation and Preliminaries-Motion Detection-Motion Estimation-Practical Motion Estimation Algorithms

UNIT 2-VIDEO ENHANCEMENT AND STABILIZATION 10

Video Enhancement and Restoration:-Spatiotemporal Noise Filtering-Coding Artifact Reduction-Blotch Detection and Removal-Vinegar Syndrome Removal-Intensity Flicker Correction- Kinescope Moiré Removal-Scratch Removal-Video Stabilization:-Insect Navigation-Camera Model and Image Motion Model-Flow Based Approaches-Video Mosaicing-Stabilization and Mosaicing with Additional Information-Motion Super Resolution-Three Dimensional Stabilization

UNIT 3-VIDEO SEGMENTATION AND MOTION TRACKING 9

Video Segmentation:-Scene Change Detection-Spatiotemporal Change Detection-Motion Segmentation-Simultaneous Motion Estimation and Segmentation-Semantic Video Object Segmentation-Performance Evaluation of Video Segmentation-Motion Tracking in Video:-Rigid Object Tracking-Articulated Object Tracking

UNIT 4-DIGITAL VIDEO TRANSCODING AND QUALITY ASSESSMENT 10

Video Transcoding For Bit Rate Reduction-Heterogeneous Video Transcoding-Bit Rate Control In Video Transcoding-Error Resilient Video Transcoding -Block Based Video Coding-EmbeddedVideo Codecs Requirements ,Constraints And Design Flow-HVS Modeling Based Methods- Motion Modeling Based Methods And Performance

UNIT 5-WIRELESS VIDEO STREAMING AND SURVEILLANCE 9

Wireless Video Streaming:-On Joint Source Channel Coding-Video Compression and Transmission-Channel Coding-Joint Source Channel Coding-Distributed Multimedia Communications-Video Surveillance:-Categorizing Applications, Target Scenes, and Video Analytics-Review of Video Analytic Algorithms.

Total: 47 periods

COURSE OUTCOMES

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

CO 1: Create a multimedia video

CO 2: Implement video processing techniques in digital cinema
CO 3: Identifies the target scenes with help of video analytics

TEXT BOOKS:

- "The Essential Guide To Video Processing Al Bovik ",Academic Press, SecondEdition 2009

REFERENCES:

- Digital Video Signal Processing –A.Murat Tekalp, Prentice Hall,1995.
- "Computer Vision: Algorithms And Applications"- Richard Szeliski,,Springer-Verlag London Limited 2011

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Create a multimedia video.	3					3								
CO2	Implement video processing techniques in digital cinema	3	2						2						
CO3	Identifies the target scenes with help of video analytics	3		3		1			2				1		1

318MCE03	INTEGRATED SOFTWARE PROJECTMANAGEMENT	L	T	P	C
		3	0	0	3

PREREQUISITES: Software Engineering

COURSE OBJECTIVES

- Understand the basic concept of project management, project planning and Evaluation.
- Learn the various costing and life cycle management.
- Understand the role played by risk in software project.
- Appreciate the use of metrics for software project management.
- Know the challenges in people management.

UNIT I PROJECT EVALUATION AND PROJECT PLANNING 9

Importance of Software Project Management – Activities Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

UNIT II PROJECT MANAGEMENT & COSTING 9

Software Project Management approaches – Project Acquisition – Initiation – Planning – PERT Execution and Control – CPM – Change Management – Project Closure – Agile SPM Problems in Software Estimation – Algorithmic Cost Estimation Process, Function Points, COCOMO II (Constructive Cost Model) – Estimating Web Application Development – Concepts of Finance, ActivityBased Costing and Economic Value Added (EVA) – Balanced Score Card.

UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT 9

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management - Risk Retention - Risk Transfer - Failure Mode and Effects Analysis (FMEA) - Operational Risks – Supply Chain Risk Management.

UNIT IV METRICS 9

Need for Software Metrics – scope – basics – framework for software measurement - Classification of Software Metrics: Product Metrics (Size Metrics, Complexity Metrics, Halstead's Product Metrics, Quality Metrics), and Process metrics (Empirical Models, Statistical Models, Theory-based Models, Composite Models, and Reliability Models) – measuring internal and external product attributes.

UNIT V PEOPLE MANAGEMENT 9

Leadership styles – Developing Leadership skills – Leadership assessment – Motivating People – Organizational strategy – Management – Team building – Delegation – Art of Interviewing People - Team Management – Rewarding - Client Relationship Management.

Total: 45 periods

COURSE OUTCOMES

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

CO 1: Identify the various elements of software management process framework

CO 2: Use available open source estimation tools for cost estimation

CO 3: Identify existing risk and perform risk assessment

CO 4: Design a software metric for software project management and people management.

TEXT BOOKS:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition,Tata McGraw Hill, New Delhi, 2012.
2. Gopalaswamy Ramesh, —Managing Global Software Projects – McGraw Hill Education (India), Fourteenth Reprint 2013.

REFERENCES:

1. Antonio Borghesi, Barbara Gaudenzi, —Risk Management: How to Assess, Transfer and Communicate Critical Risks: Perspectives in Business Culture , Illustrated Edition, Springer, 2012.
2. Murali Chemuturi, Thomas M. Cagley, —Mastering Software Project Management: Best Practices, Tools and Techniques , J. Ross Publishing, 2010.
3. Norman Fenton, James Bieman, —Software Metrics: A Rigorous and Practical Approach , 3rd edition, CRC Press, 2015.
4. Stark, John, —Decision Engineering: Product Lifecycle Management:21st Century Paradigmfor Product Realisation , 2ndEdition, Springer London, 2011.

Course Outcomes		PSo1	PSO 2	PSO 3	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Identify the various elements of software management process framework.	3					3								
CO2	Use available open source estimation tools for cost estimation	3	2						3					1	
CO3	Identify existing risk and perform risk assessment.	3					3		1						
CO4	Design a software metric for software project management and people management.	3		3			3					1			

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318MCE04	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand fundamental concepts of Big Data.
- Explore knowledge on Data Analysis methods.
- Be Familiar withpredictive analytics and visualization tools.
- Gain Knowledge on Streaming in big data.
- LearnR programming for Big data analytics.

UNIT I INTRODUCTION TO BIG DATA 9

Big Data – Definition, Characteristic Features – Big Data Applications - Big Data vs Traditional Data - Risks of Big Data - Structureof Big Data - Challenges of Conventional Systems - Web Data – Evolution of Analytic Scalability - Evolution of Analytic Processes, Tools and methods -Analysis vs Reporting - Modern Data Analytic Tools.

UNIT II DATA ANALYSIS 9

Statistical Methods: Regression modelling, Multivariate Analysis - Classification: SVM & Kernel Methods - Rule Mining - Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Clustering High Dimensional Data

UNIT III PREDICTIVE ANALYTICS AND VISUALIZATION 9

Predictive Analytics – Supervised – Unsupervised learning – Neural networks – Kohonen models – Normal – Deviations from normal patterns – Normal behaviours –Mining Frequent itemsets - Market based model –Handling large data sets in Main memory – Limited Pass algorithm – Counting frequentitemsets in a stream – KMeans – Clustering high dimensional data Visualizations - Visual data analysis techniques - Interaction techniques

UNIT IV MINING DATA STREAMS 9

Streams: Concepts – Stream Data Model and Architecture - Sampling data in a stream - Mining Data Streams and Mining Time-series data - Real Time Analytics Platform (RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions

UNIT V BIG DATA ANALYTICS USING R 9

Introduction to R – Data types - Operations – Statistics – Generic Functions – Data analytics method using R – Examining Single and Pairs of variables – Indication of Dirty data – Statistics for model building and evaluation – Statistics in analytic life cycle – Hypothesis testing – Difference of means – Welch's t-Test – Wilcoxsn rank sum Test – ANOVA – An R example for ANOVA.

Total: 45 Periods

COURSE OUTCOMES

At the end of the course the students are able to

CO 1: Realize how to leverage the insights from big data analytics

CO 2: Analyze data by utilizing various statistical and data mining approaches

CO 3: Perform analytics on real-time streaming data.

CO 4: Recommend areas to apply big data frameworks to increase business outcome

CO 5: Implement Data analytics method using R.

REFERENCES:

1. Bill Franks, —Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Wiley and SAS Business Series, 2012.
2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.
3. Michael Berthold, David J. Hand, —Intelligent Data Analysis, Springer, Second Edition, 2007.
4. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
5. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
6. Richard Cotton, "Learning R – A Step-by-step Function Guide to Data Analysis" O'Reilly Media, 2013.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Realize how to leverage the insights from big data analytics	3				3									1
CO2	Analyze data by utilizing various statistical and data mining approaches	3	2			3						1			1
CO3	Perform analytics on real-time streaming data	3		3			2								
CO4	Recommend areas to apply big data frameworks to increase business outcome	3					2					1			
CO5	Implement Data analytics method using R	3					2			2	1				

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318MCE05	VIRTUALIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the need of virtualization
- To explore the types of virtualization
- To understand the concepts of virtualization and virtual machines
- To understand the practical virtualization solutions and enterprise solutions
- To understand theconcepts of cloud computing
- To have an introduction to cloud programming giving emphasis to Hadoop MapReduce
- To understand the security issues in cloud computing

UNIT I OVERVIEW OF VIRTUALIZATION

Basics of Virtualization –Types of Virtualization Techniques –Merits and demerits of Virtualization – Full Vs Para-virtualization –Virtual Machine Monitor/Hypervisor -Virtual Machine Basics –Taxonomy of Virtual machines –Process Vs System Virtual Machines – Emulation: Interpretation and Binary Translation -HLL Virtual Machines

UNIT II SERVER AND NETWORK VIRTUALIZATION

Server Virtualization: Virtual Hardware Overview -Server Consolidation –Partitioning Techniques -Uses of Virtual server Consolidation –Server Virtualization Platforms, Network Virtualization:Design of Scalable Enterprise Networks –Layer2 Virtualization –VLAN -VFI - Layer 3 Virtualization –VRF -Virtual Firewall Contexts -Network Device Virtualization -Data- Path Virtualization -Routing Protocols

UNIT III STORAGE, DESKTOP AND APPLICATION VIRTUALIZATION

Storage Virtualization:Hardware Devices –SAN backup and recovery techniques –RAID – Classical Storage Model –SNIA Shared Storage Model –Virtual Storage: File System Level and Block Level, Desktop Virtualization:Concepts -Desktop Management Issues -Potential Desktop Virtualization Scenarios -Desktop Virtualization Infrastructures, Application Virtualization:Concepts -Application Management Issues -Redesign Application Management – Application Migration

UNIT IV APPLYING VIRTUALIZATION

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

UNIT V CLOUD COMPUTING

Cloud Computing Basics -Cloud Computing Definition –Evolution of Clod Computing -General Cloud Environments –Cloud Services –Service Providers –Google –Amazon –Microsoft –IBM – EMC –NetApp

–Salesforce –Tools for building private cloud -Open Issues in Cloud Computing –Cloud security challenges, Cloud Programming:Hadoop –MapReduce –HDFS –Hadoop I/O – Developing a MapReduce Application

Total: 45 periods

COURSE OUTCOMES

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

CO 1: Deploy legacy OSs on virtual machines

CO 2: Understand the intricacies of server, storage, network, desktop and application virtualizations

CO 3: Design new models for virtualization

CO 4: Design and develop cloud applications on virtual machine platforms

CO 5: Design new models for Bigdata processing in cloud

REFERENCES:

1. James E. Smith, Ravi Nair, -Virtual Machines: Versatile Platforms for Systems and Processes, Elsevier/Morgan Kaufmann, 2005.
2. David Marshall, Wade A. Reynolds, -Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach Publications, 2006.
3. Kumar Reddy, Victor Moreno, -Network virtualization, Cisco Press, July, 2006.
4. Chris Wolf, Erick M. Halter, -Virtualization: From the Desktop to the Enterprise, APress 2005.
5. DanielleRuest, Nelson Ruest -Virtualization: A Beginner's Guide, TMH, 2009
6. Kenneth Hess , Amy Newman: Practical Virtualization Solutions: Virtualization from the Trenches Prentice Hall 2010
7. John Rittinghouse, James Ransome, Cloud Computing, Implementation, Management and Strategy, CRC Press, 2010
8. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter -Cloud Computing: A Practical Approach, TMH, 2010.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Deploy legacy OSs on virtual machines.	3		3					2						
CO2	Understand the intricacies of server, storage, network, desktop and application virtualizations	3								2				1	
CO3	Design new models for virtualization	3	2				2								1
CO4	Design and develop cloud applications on virtual machine platforms.	3					2								1
CO5	Design new models for Bigdata processing in cloud	3					2			2					

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		L	T	P	C
318MCE06	MODELLING AND SIMULATION OF WIRELESS COMMUNICATION SYSTEM	3	0	0	3

OBJECTIVES:

- To understand the aspect of simulation and modeling.
- To understand random signals and process
- To get exposed to simulation methods for wireless systems
- To know modeling procedures for various channels.

UNIT I INTRODUCTION 9

Role of Simulation: Examplesof complexity -multidisciplinary aspects of simulation -models - deterministic and stochastic simulations; Simulation methodology -aspects of methodology - performance estimation; Fundamental Concepts and Techniques: Sampling -quantizing - reconstruction and interpolation -simulation sampling frequency -low pass simulation models forband pass –low pass complex envelope for bandpass signals -linear bandpass systems - multicarriersignals - nonlinear and time -varying systems.

UNIT II GENERATING AND PROCESSING RANDOM SIGNALS 9

Stationary and Ergodic Processes: Uniform random number generators -mapping uniform RVs toan arbitrary PDF -generating uncorrelated Gaussian random numbers -generating correlated Gaussian random numbers -PN sequence generators; Establishing a PDF and a PSD Post Processing: Basic graphical techniques -estimation -coding.

UNIT III METHODOLOGY FOR SIMULATING A WIRELESS SYSTEM 9

Monte Carlo Simulation Fundamental Concepts: Applications and integration -two Monte Carlo examples; Semi Analytic Techniques System: Level simplifications and sampling rateconsiderations - overall methodology; Modeling and Simulation of Nonlinearities: Introduction - modeling and simulation of memory less nonlinearities -modeling and simulation of nonlinearitieswith memory - techniques for solving nonlinear differential equations. Prerequisite : Basic knowledge of C programming, signals and systems, digital communication and digital signal processing.

UNIT IV MODELING AND SIMULATION OF TIME-VARYING SYSTEMS 9

Introduction: Models for LTV systems -random process models -simulation models for LTV systems; Wired and guided wave -radio channels -multipath fading channels -modeling multipath fading channels; Random process models -simulation methodology; Discrete Channel Models: Discrete memory less channel models -Markov models for discrete channels with memory- example HMMs - Gilbert and Fritchman models -estimation of Markov model parameters.

UNIT V EFFICIENT SIMULATION TECHNIQUES 9

Tail Extrapolation: PDF estimators-importance sampling; Case study of a cellular radio system; Cellular radio system -simulation methodology -modeling co-channel interference -two example simulations; A code-division multiple access system -FDM system with a nonlinear satellite transponder - preprocessors for CDMA application.

Total: 45 periods

COURSE OUTCOMES

CO 1: To be able to design various models for wireless communication
CO 2: To be able to simulate various channels
CO 3: To apply for various wireless communication technologies

REFERENCES:

1. William H. Tranter, K. Sam Shanmugan, Theodore S. Rappaport and Kurt L. Kosbar "Principles of Communication Systems Simulation with Wireless Applications", Prentice Hall, Upper Saddle River, 2003.
2. M. C. Jeruchim, Philip Balaban and K.Sam shanmugam. "Simulation of Communication Systems", Plenum Press, 2007.
3. 3 .M. Law and W. David Kelton, "Simulation Modelling and Analysis", McGraw Hill, 2008.
4. K. Hayes, "Modelling and Analysis of Computer Communication Networks", Plenum Press, 1984.
5. Banks, J. S. Carson, Nelson and D. M. Nicol, "Discrete Event System Simulation", 4th Edition, Prentice Hall of India, 2005.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	To be able to design various models for wireless communication	3					3								
CO2	To be able to simulate various channels	3	2											1	
CO3	To apply for various wireless communication technologies	3		3		1								1	

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318MCE08	SPEECH PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the fundamentals of the speech processing
- Explore the various speech models
- Gather knowledge about the phonetics and pronunciation processing
- Perform wavelet analysis of speech
- To understand the concepts of speech recognition

UNIT I INTRODUCTION 9

Introduction – knowledge in speech and language processing – ambiguity – models and algorithms – language – thought – understanding – regular expression and automata – words & transducers – N grams

UNIT II SPEECH MODELLING 9

Word classes and part of speech tagging – hidden markov model – computing likelihood: the forward algorithm – training hidden markov model – maximum entropy model – transformation-based tagging– evaluation and error analysis – issues in part of speech tagging – noisy channel model for spelling

UNIT III SPEECH PRONUNCIATION AND SIGNAL PROCESSING 9

Phonetics – speech sounds and phonetic transcription – articulatory phonetics – phonological categories and pronunciation variation – acoustic phonetics and signals – phonetic resources – articulatory and gestural phonology

UNIT IV SPEECH IDENTIFICATION 9

Speech synthesis – text normalization – phonetic analysis – prosodic analysis – diphone waveform synthesis – unit selection waveform synthesis – evaluation.

UNIT V SPEECH RECOGNITION 9

Automatic speech recognition – architecture – applying hidden markov model – feature extraction: mfcc vectors – computing acoustic likelihoods – search and decoding – embedded training – multipass decoding: n-best lists and lattices- a* (_stack') decoding – context-dependent acoustic models: triphones – discriminative training – speech recognition by humans

Total: 45 periods

COURSE OUTCOMES

At the end of the course the students are able to

CO 1: Create new algorithms with speech processing
CO 2: Derive new speech models
CO 3: Perform various language phonetic analysis
CO 4: Create a new speech identification system
CO 5: Generate a new speech recognition system

TEXT BOOK:

1. Daniel Jurafsky and James H. Martin, — Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, Person education,2013.

REFERENCE BOOKS:

1. Kai-Fu Lee, —Automatic Speech Recognition, The Springer International Series inEngineering and Computer Science, 1999.
2. Himanshu Chaurasiya, —Soft Computing Implementation of Automatic Speech Recognition, LAP Lambert Academic Publishing, 2010.
3. Claudio Becchetti, Klucio Prina Ricotti, —Speech Recognition: Theory and C++ implementation,Wiley publications 2008.
4. Ikrami Eldirawy, Wesam Ashour, —Visual Speech Recognition, Wiley publications , 2011

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Create new algorithms with speech processing.	3					3								1
CO2	Derive new speech models	3	2				3								
CO3	Perform various language phonetic analysis	3						2							
CO4	Create a new speech identification system	3		3				2			1				1
CO5	Generate a new speech recognition system	3						2							

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318MCE08	ERP AND CONCEPTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Know the concepts and knowledge of ERP.
- Focus on illustrating procurement, production, and sales business processes usingERP software.
- Bridge the gap between the need of business process knowledge and its application tothe business environment.
- Learn ERP Implementation Success & Failure for an application.
- Appreciate ERP in various public and private sector.

UNIT I INTRODUCTION TO ERP 9

Overview – Benefits of ERP – ERP and Related Technologies – ERP Risks – Benefits - Data Warehousing – Data Mining – On–line Analytical Processing – Data Migration – ERP, Internetand WWW.

UNIT II ERP IMPLEMENTATION 9

Implementation Life Cycle – cost model - Implementation Methodology – Hidden Costs – Organizing Implementation – Vendors, Consultants and Users – Contracts – ERP Project Management and Monitoring - Business case and ROI analysis - ERP and business process reengineering.

UNIT III BUSINESS MODULES 9

Finance Management – Manufacturing Management – Human capital Management – Procurement and Inventory Management – Supplier Relationship Management – Supply chain planning & Management - Logistics Management - Plant Maintenance – Materials Management – Quality Management – Sales and Distribution – Enterprise Asset Management– Product Lifecycle Management.

UNIT IV ERP MARKET 9

ERP & E-business – ERP & CRM - ERP Market Place – SAP–ERP financials – Auditing ERP – ERP Business Intelligence and Performance Management – ERP for manufacturing: Auto, Pharma, Consumer Products, Mining – ERP for service sector: Retail, Healthcare, Telecom, Banking, Insurance, Educational Institutions.

UNIT V ERP – APPLICATIONS 9

Lean manufacturing and ERP - Turbo Charge the ERP System – EIA Study of ERP selectionprocess – Big Bang ERP implementation – Impact of ERP systems on organizational effectiveness – Knowledge management for enterprise systems – Managing ERP security.

Total: 45 periods

COURSE OUTCOMES

At the end the student will be able to

CO1: Become a manager of computer service offerings, across business processes of an organization.

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CO2: Understand the structure of an ERP system

CO3: Prepare them to become knowledgeable ERP user professionals suitable toIndustry and Information Technology Companies.

REFERENCES:

1. Alexis Leon, —Enterprise Resource Planning, Tata McGraw Hill, 2nd Edition, 2008
2. Ray, —Enterprise Resource Planning, Tata McGraw Hill, 2011
3. Veena Bansal, —Enterprise Resource Planning, Pearson Education India. 2013
4. Marianne Bradford, —Modern ERP – Select, Implement and Use– Today's Advanced Business Systems, North Carolina State University, Second Edition, 2010
5. Narayanan, —Implementing SAR-ERP Financials – A configuration Guide, TataMcGraw Hill, 2010
6. Joseph A. Brady, Ellen F. Monk, Bret J. Wangner, —Concepts in EnterpriseResource Planning, Thomson Learning, 2001.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Become a manager of computer service offerings, across business processes ofan organization	3			1								2		
CO2	Understand the structure of an ERP system	3	2					1			1				
CO3	Prepare them to become knowledgeable ERP user professionals suitable to Industry and Information Technology Companies	3		3	1						1		1		

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318MCE09	DEEP LEARNING	L	T	P	C
		3	0	0	3

PREREQUISITES: Python, Artificial Intelligence, Machine Learning.

COURSE OBJECTIVES

- To present the mathematical, statistical and computational challenges ofbuilding neural networks.
- To study the concepts of deep learning.
- To introduce dimensionality reduction techniques.
- To enable the students to know deep learning techniques to support real-timeapplications.
- To examine the case studies of deep learning techniques

UNIT I INTRODUCTION 9

Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression) - Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates.

UNIT II DEEP NETWORKS 9

History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks- Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning

UNIT III DIMENTIONALITY REDUCTION 9

Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization

UNIT IVOPTIMIZATION AND GENERALIZATION 9

Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization- Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience

UNIT V CASE STUDY AND APPLICATIONS 9

Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec - Joint Detection-BioInformatics- Face Recognition- Scene Understanding- Gathering Image Captions

Total: 45 periods

COURSE OUTCOMES

At the end of the course the students are able to

CO 1: Understand basics of deep learning
CO 2: Implement various deep learning models
CO 3: Realign high dimensional data using reduction techniques
CO 4: Analyze optimization and generalization in deep learning
CO 5: Explore the deep learning applications.

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REFERENCES:

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an lementary Point of View, 2015.
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Understand basics of deep learning.	3				3									
CO2	Implement various deep learning models	3							1						
CO3	Realign high dimensional data using reduction techniques	3	2				2					1			
CO4	Analyze optimization and generalization in deep learning.	3					2							1	
CO5	Explore the deep learning applications	3		3									1		

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318MCE10	DIGITAL FORENSICS	L	T	P	C
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COURSE OBJECTIVES

- To have a fundamental understanding of Digital Forensics.
- To apply appropriate skills and knowledge in solving computer forensics problems.
- To apply theoretical and practical knowledge in forensic computing into the future.

UNIT-I INTRODUCTION TO COMPUTER FORENSICS 9

History of Forensics – Computer Forensic Flaws and Risks – Rules of Computer Forensics – Legal issues – Digital Forensic Principles – Digital Environments – Digital Forensic Methodologies.

UNIT II AN OVERVIEW OF DIGITAL FORENSICS INVESTIGATION 9

Live forensics and investigation –digital evidence – seizure methodology actors limiting the wholesale seizure of hardware-Demystifying computer/cyber crime – explosion Of networking – explosion of wireless networks – interpersonal communication.

UNIT-III DATA FORENSICS 9

Recovering deleted files and deleted partitions – deleted file recovery tools – deleted partitioned recovery tools – data acquisition and duplication – data acquisition tools – hardware tools – backing up and duplicating data.

UNIT-IV ROUTER FORENSICS AND NETWORK FORENSICS 9

An overview of Routers – Hacking Routers – Investigating Routers – Investigating Wireless Attacks – Basics of wireless – Wireless Penetration Testing – Direct Connections to Wireless Access Point – Wireless Connectto a Wireless Access Point.

UNIT-V E-MAIL FORENSICS AND STEGANOGRAPHY 9

Forensics Acquisition – Processing Local mail archives – Processing server level archives – classification of steganography – categories of steganographyin Forensics – Types of password cracking.

Total: 45 periods

COURSE OUTCOMES

Upon completion of this program, students will be able to:

CO 1: have a fundamental understanding of Digital Forensics and how resultantevidence can be applied within legal cases.

CO 2: display their competence in the various forensic computing fields.

CO 3: perform competitively as a technical support in any organization

REFERENCES:

1. Anthony Reyes, Jack Wiles, "Cybercrime and Digital Forenscis", Syngress Publishers, Elsevier 2007.
2. John Sammons, "The Basics of Digital Forensics", Elsevier 2012

3. Linda Volonins, Reynalds Anzaldua, "Computer Forensics for dummies", WileyPublishing 2008.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	have a fundamental understanding of Digital Forensics and how resultantevidence can be applied within legal cases.	3						3			1		1		
CO2	display their competence in the various forensic computing fields.	3	2					3				1			
CO3	perform competitively as a technical support in any organization	3		3	3			3					1		

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