PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637 018

(AUTONOMOUS)

M.E. COMPUTER SCIENCE AND ENGINEERING - PART TIME

CURRICULUM

REGULATIONS 2015

SEMESTER III

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	PCS15301	Cloud Computing	3	0	0	3
2.	PCS15302	Advanced Operating Systems	3	0	0	3
3.	PCS15E**	Elective I	3	0	0	3
4.	PCS15303	Technical Report Preparation and Presentation	0	0	4	2

SEMESTER IV

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	PCS15401	Soft Computing	3	0	0	3
2.	PCS15402	Big Data Analytics	3	0	0	3
3.	PCS15E**	Elective II	3	0	0	3

LIST OF ELECTIVES

ELECTIVE I

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	PCS15E01	Digital Image Processing and Analysis	3	0	0	3
2.	PCS15E02	Massive Parallel Processing	3	0	0	3
3.	PCS15E03	Ad-hoc and Wireless Networks	3	0	0	3
4.	PCS15E04	Data Visualization Techniques	3	0	0	3
5.	PCS15E05	Speech Processing and Synthesis	3	0	0	3

ELECTIVE II

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	PCS15E06	Storage Area Networks	3	0	0	3
2.	PCS15E07	Ad-hoc & Sensor Networks	3	0	0	3
3.	PCS15E08	Cluster and Grid Computing	3	0	0	3
4.	PCS15E09	Information Retrieval	3	0	0	3
5.	PCS15E10	Bio Informatics	3	0	0	3

SEMESTER III

PCS15301 CLOUD COMPUTING 3 0 0 3

COURSE OBJECTIVES

- To analyze different virtualization concepts
- To understand the concept of cloud and utility computing.
- To understand the various issues in cloud computing.
- To familiarize themselves with the types of virtualization and lead players in cloud.
- To learn the emergence of cloud as the next generation computing paradigm.

UNIT I OVERVIEW OF VIRTUALIZATION 8

Basics of Virtualization - Virtualization Types – Desktop Virtualization – Network Virtualization – Server and Machine Virtualization – Storage Virtualization – System-level of Operating Virtualization – Application Virtualization- Virtualization Advantages - Virtual Machine Taxonomy of Virtual Machines - Process Virtual Machines - System Virtual Machines – Hypervisor – Interpretation and Binary translation.

UNIT II VIRTUALIZATION STRUCTURES 8

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

UNIT III CLOUD INFRASTRUCTURE 9

Scalable Computing over the Internet – Technologies for Network based Systems - System Models for Distributed and Cloud Computing – Service Oriented Architecture – NIST Cloud Computing Reference Architecture. Cloud Computing and Services Model – Public, Private and Hybrid Clouds – Cloud Eco System - IaaS -PaaS – SaaS. Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources Case Study: Amazon Web Service reference, GoGrid, Rackspace.

UNIT IV PROGRAMMING MODEL 10

Parallel and Distributed Programming Paradigms – Map Reduce , Twister and Iterative Map Reduce – Hadoop Library from Apache – Mapping Applications - Programming Support - Google App Engine, Amazon AWS - Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack. Cloud Sim – Architecture - Cloudlets – VM creation – Broker – VM allocation – Hosts.

UNIT V SECURITY IN THE CLOUD AND RESOURCE MANAGEMENT 10

Cloud Computing Risk Issues – Cloud Computing Security Challenges – Cloud Computing Security Architecture – Trusted cloud Computing – Identity Management and Access Control – Autonomic Security. Dynamic Resource Allocation Using Virtual Machines for Cloud Computing Environment - Optimization of Resource Provisioning Cost in Cloud Computing.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- recognize the strengths and limitations of cloud computing.
- identify the architecture, infrastructure and delivery models of cloud computing Applications.
- suggest solutions for the core issues of cloud computing such as security, privacy and interoperability.
- decide the appropriate technologies, algorithms and approaches for the related issues.
- deal security challenges in cloud environment.

REFERENCES

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Ronald L. Krutz, Russell Dean Vines, "Cloud Security – A comprehensive Guide to Secure Cloud Computing", Wiley – India, 2010.
3. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
4. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud", O'Reilly
5. Sivadon Chaisiri, Bu-Sung Lee, and DusitNiyato, "Optimization of Resource Provisioning Cost in Cloud Computing", IEEE Transactions on Services Computing, Vol. 5, No. 2, 2012.

PCS15302 ADVANCED OPERATING SYSTEMS 3 0 0 3

COURSE OBJECTIVES

- To learn the fundamentals of Operating Systems.
- To understand storage management and I/O systems.
- To gain knowledge on Distributed operating system concepts.
- To know the components and management aspects of Real Time Mobile operating systems.
- To understand the working principles of Linux operating system.

UNIT I FUNDAMENTALS OF OPERATING SYSTEMS 9

Overview–Operating system structure and operation- Processes and Threads-Process Scheduling– Process Synchronization Mechanisms–Deadlocks: Avoidance, Detection, Prevention and Memory Management Techniques.

UNIT II STORAGE MANAGEMENT AND I/O SYSTEMS 9

Main memory – Paging-Segmentation – Segmentation with Paging –Virtual memory – Demand paging – Page replacement – Allocation – Thrashing. I/O Systems – Mass storage structure – disk scheduling and management – File system Interface – Directory and disk structure – File system implementation – Allocation methods – Free space management - I/O systems.

UNIT III DISTRIBUTED OPERATING SYSTEMS 9

Issues in Distributed Operating System – Architecture – Communication Primitives – Lamport's Logical clocks –Causal Ordering of Messages –Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms – Agreement Protocols. – Distributed resource management – distributed file systems.

UNIT IV REAL TIME AND MOBILE OPERATING SYSTEMS 9

Basic Model of Real Time Systems-Characteristics- Applications of Real Time Systems– Real Time Task Scheduling -Handling Resource Sharing -Mobile Operating Systems – Micro Kernel Design- Client Server Resource - Access–Processes and Threads- Memory Management-File system.

UNIT V CASE STUDIES 9

Linux System: Design Principles -Kernel Modules -Process Management Scheduling - Memory Management- Input-Output Management - File System - Inter process Communication. IOS and Android: Architecture and SDK Framework - Media Layer – Services Layer-Core OS Layer-File System.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- analyse the various synchronization, scheduling and deadlock issues.
- understand the primary and secondary memory management and file systems.
- demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system.
- identify the different features of real time and mobile operating systems.
- modify existing open source kernels in terms of functionality or features used.

REFERENCES

1. Mukesh Singhal and Niranjan G.Shivaratri, "Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill,2001.
2. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley & Sons, 2012.
3. Daniel P Bovet and Marco Cesati, "Understanding the Linux kernel", 3rd edition, O'Reilly, 2005.
4. RajibMall, "Real-Time Systems: Theory and Practice", Pearson Education India, 2006.
5. NeilSmyth, "iPhone iOS4 Development Essentials–Xcode", Fourth Edition, Payload media, 2011.
6. William stallings, "operating systems- Internals and design principles" 7th edition, Prentice Hall, 2011.

SEMESTER IV

PCS15401 SOFT COMPUTING 3 0 0 3

COURSE OBJECTIVES

- To learn soft computing concepts and techniques.
- To understand neural network and fuzzy logic methods.
- To design and develop intelligent systems in the framework of soft computing,
- To learn and implement research oriented genetic algorithms.
- To acquire knowledge of scientific application-driven environments.

UNIT I SOFT COMPUTING BASICS 9

Introduction-soft computing vs. hard computing-various types of soft computing techniques- applications of soft computing-Basic tools of soft computing – Fuzzy logic-neural network-evolutionary computing-Introduction: Neural networks- application scope of neural networks-fuzzy logic-genetic algorithm-hybrid systems.

UNIT II NEURAL NETWORKS 9

Neuron-Nerve structure and synapse-Artificial Neuron and its model-activation functions-Neural network architecture: single layer and multilayer feed forward networks-recurrent networks. Various learning techniques; perception and convergence rule-Auto associative and hetro-associative memory-perceptron model-single layer artificial neural network-multilayer perception model; back propagation learning methods- effect of learning rule co-efficient ;back propagation algorithm-factors affecting back propagation training- applications.

UNIT III FUZZY LOGIC 9

Basic concepts of fuzzy logic-Fuzzy sets and Crisp sets-Fuzzy set theory and operations-Properties of fuzzy sets-Fuzzy and Crisp relations- Fuzzy to Crisp conversion. Membership functions-interference in fuzzy logic- fuzzy if-then rules-Fuzzy implications and Fuzzy algorithms-Fuzzyfications & Defuzzifications-Fuzzy Controller-Fuzzy rule base and approximate reasoning: truth values and tables in fuzzy logic-fuzzy propositions formation of rules-decomposition of compound rules-aggregation of fuzzy rules-fuzzy reasoning, fuzzy inference system-fuzzy expert systems.

UNIT IV GENETIC ALGORITHM 9

Basic concepts-working principle- procedures of GA-flow chart of GA-Genetic representations-(encoding) Initialization and selection- Genetic operators,-Mutation-Generational Cycle-Traditional algorithm vs. genetic algorithm-simple GA-general genetic algorithm-schema theorem-Classification of genetic algorithm-Holland classifier systems-genetic programming-applications of genetic algorithm-

Convergence of GA-Applications & advances in GA-Differences & similarities between GA & other traditional method-applications.

UNIT V EVOLUTIONARY COMPUTING 9

Role of biologically inspired software-Difficulties in search-optimization and machine learning-Overview of natural evolution and its abilities-Evolutionary Programming/Evolutionary Strategies Issues in evolutionary search-applying an evolutionary algorithm-Artificial Life- Ant colony optimization-Swarm intelligence.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- identify and describe soft computing techniques and their roles in building intelligent machines.
- recognize the feasibility of applying a soft computing methodology for a particular problem.
- apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
- develop genetic algorithm based applications.
- acquire knowledge in evolutionary computing environment.

REFERENCES

1. S.Rajsekaran & G.A. Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications” ,Prentice Hall of India.
2. N.P.Padhy,”Artificial Intelligence and Intelligent Systems” ,Oxford University Press.
3. J S R Jang and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI Pvt Ltd.
4. Sivandudam and Deepa , “Principles of soft computing”, John Mikey India.
5. Ross Timothy J, “Fuzzy Logic with Engineering Applications”, Wiley India Pvt Ltd, New Delhi, 2010

PCS15402 BIG DATA ANALYTICS 3 0 0 3

COURSE OBJECTIVES

- To explore the fundamental concepts of big data and analytics.
- To learn various techniques for mining data stream.
- To analyze big data using intelligent techniques.
- To apply search methods and visualization.
- To design applications using Map Reduce Concepts.

UNIT I INTRODUCTION TO BIG DATA 9

Introduction to Big Data Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis Vs Reporting - Modern Data Analytic Tools – Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error

UNIT II DATA ANALYSIS 9

Regression Modelling - Multivariate Analysis – Bayesian Methods – Bayesian Paradigm - Bayesian Modeling - Inference and Bayesian Networks - Support Vector and Kernel Methods - Analysis of Time Series: Linear Systems Analysis - Nonlinear Dynamics - Rule Induction - Fuzzy Logic: Extracting Fuzzy Models from Data - Fuzzy Decision Trees

UNIT III SEARCH METHODS AND VISUALIZATION 9

Search by simulated Annealing – Stochastic, Adaptive search by Evaluation – Evaluations Strategies – Genetic Algorithm – Genetic Programming – Visualization – Classification of Visual Data Analysis Techniques – Data Types – Visualization Techniques – Interaction techniques – Specific Visual data analysis Techniques

UNIT IV MINING DATA STREAMS 9

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

UNIT V FRAMEWORKS 9

Map Reduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed File Systems– Case Study- Preventing Private Information Inference Attacks on Social Networks-Grand Challenge: Applying Regulatory Science and Big Data to Improve Medical Device Innovation.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- work in big data platform and its analysis techniques.
- design efficient algorithms for mining the data from large volumes.
- model a framework for human activity recognition.
- analyze the big data for useful business applications.
- implement search methods and visualization.

REFERENCES

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
3. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.
4. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007.
5. Pete Warden, "Big Data Glossary", O'Reilly, 2011.
6. Jiawei Han, MichelineKamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.
7. Raymond Heatherly, Murat Kantarcioglu and Bhavani Thuraisingham, "Preventing Private Information Inference Attacks on Social Networks" IEEE Transaction on Knowledge and Data Engineering, Vol 25, No.8 August 2013.

ELECTIVE I

PCS15E01 DIGITAL IMAGE PROCESSING AND ANALYSIS 3 0 0 3

COURSE OBJECTIVES

- To understand image models and it's processing.
- To learn spatial, frequency domain filters.
- To study basic image analysis segmentation, edge detection, and corner detection.
- To learn morphological operations and texture analysis.
- To acquire knowledge in image analysis.

UNIT I IMAGE MODELS AND PROCESSING 9

Introduction to image processing–imaging modalities–image file formats–image sensing and acquisition – image sampling and quantization – noise models – spatial filtering operations–histograms–smoothing filters–sharpening filters– fuzzy techniques for spatial filtering–spatial filters for noise removal - Colour models – pseudo colours - colour transformations.

UNIT II FREQUENCY DOMAIN PROCESSING 9

Frequency domain–Review of Fourier Transform(FT),Discrete Fourier Transform (DFT), and Fast Fourier Transform (FFT) –filtering infrequency domain –image smoothing – image sharpening –selective filtering–frequency domain noise filters–wavelets –Haar Transform– multi resolution expansions– wavelet transforms– wave lets based image processing.

UNIT III SEGMENTATION AND EDGE DETECTION 9

Thresholding techniques– region growing methods– region splitting and merging– adaptive thresholding– threshold selection–global valley– histogram concavity– edge detection– template matching–gradient operators– circular operators– differential edge operators– hysteresis thresholding– Canny operator – Laplacian operator –active contours–object segmentation.

UNIT IV INTEREST POINTS, MORPHOLOGY, AND TEXTURE 9

Corner and interest point detection – template matching – second order derivatives – median filter based detection –Harris interest point operator –corner orientation –local invariant feature detectors and descriptors – morphology – dilation and erosion – morphological operators– gray scale morphology– noise and morphology–texture–texture analysis –co-occurrence matrices –Laws' texture energy approach –Ade's Eigen filter approach.

UNIT V IMAGE ANALYSIS 9

Feature extraction – reduction – Image retrieval and its performance – Syntax and introduction to semantic based retrieval – introduction to watermarking – steganography –Image Compression –

redundancy in images – coding redundancy – irrelevant information in images – image compression models – basic compression methods – Introduction to compression standards.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- implement spatial, frequency filter operations.
- implement frequency domain filters.
- apply segmentation algorithms and edge detection techniques.
- perform texture analysis.
- analyse images and implement image compression algorithms.

REFERENCES

1. E.R.Davies, "Computer& Machine Vision", Fourth Edition, Academic Press, 2012.
2. W. Burger and M. Burge, "Digital Image Processing: An Algorithmic Introduction using Java", Springer, 2008.
3. John C.Russ, "The Image Processing Handbook", Sixth Edition, CRC Press, 2011.
4. R.C.Gonzalez and R.E.Woods, "Digital Image Processing", Third Edition, Pearson, 2008.
5. Mark Nixonand Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", Third Edition, Academic Press, 2012.
6. D.L.Baggioetal., "Mastering Open CV with Practical Computer Vision Projects", Packt Publishing, 2012.
7. Jan Erik Solem, "Programming Computer Vision with Python: Tools and algorithms for analyzing images", O'Reilly Media, 2012.

PCS15E02 MASSIVE PARALLEL PROCESSING 3 0 0 3

COURSE OBJECTIVES

- To study about the cache memory and cache performance issue.
- To learn detailed study of different architectures.
- To understand vector pipeline architectures and pipelined CPU architecture.
- To analyse RISC, CISC Scalar processor architecture.
- To know virtual channels and parallel processing applications.

UNIT I OVERVIEW OF MODERN PROCESSOR ARCHITECTURES 9

Memory Hierarchy - Cache and Cache Coherence Caches- associatively - allocation and replacement policies - sub-block placement. Multilevel caches -multilevel inclusion - Cache performance issues.

UNIT II BUS ARCHITECTURE IMPLEMENTATIONS OF SHARED MEMORY 9

The cache coherence problem - Update vs. invalidation - The bus-based snooping protocol design space - Scalable-shared memory using directory-based cache coherency - MESI protocol.

UNIT III VECTOR PIPELINE AND PIPELINED CPU ARCHITECTURE 9

Instruction set design and pipeline structure- instruction Pipeline Design -Arithmetic pipeline design – Super -scalar and Super pipeline design -Dynamic scheduling using score boarding and Tomasulo's algorithm -Software instruction scheduling and software pipelining -Super-scalar and long-instruction-word architectures -Branch prediction and speculative execution.

UNIT IV REPLICATED ARCHITECTURES 9

SIMD/MIMD-Shared Memory and Distributed Memory -RISC, CISC Scalar processors - super Scalar and VLIW Computers - Multi-vector Computers - Connectivity Interconnection networks: topology-routing - flow control -deadlock avoidance - static and dynamic interconnection networks.

UNIT V VIRTUAL CHANNELS 9

Program and Network Properties- Conditions of parallelism- Program Partitioning -and Scheduling-Program flow mechanisms- Principles of Scalable Performance- Performance Metrics and Measures-Parallel processing Applications Speedup Performance laws.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- understand the cache memory and cache performance issue.
- expose the detailed study of different architectures.
- implement vector pipeline architectures and pipelined cpu architecture.

- understand risc, cisc scalar processor architecture.
- analyze the memory and i/o systems and their performance issues.

REFERENCES

1. John L. Hennessy, David A. Patterson, “Computer Architecture, A Quantitative approach”, Morger Kaufmann Publishers, 3rd Edition, 2003.
2. Kai Hwang, “Advanced Computer Architecture: Parallelism, Scalability and Programmability” McGrawHill, 2001.
3. John L. Hennery, David A. Patterson, “Computer organization and design: The hardware / software interface, 2nd Edition, Morgan Kaufman Publishers, 2012.
4. Morris Mano M, “Computer System Architecture”, Pearson Education, 2014.
5. William stallings, “Computer Organization and Architecture: Designing for Performance”, Prentice Hall, 2014.

PCS15E03 AD- HOC AND WIRELESS NETWORKS 3 0 0 3

COURSE OBJECTIVES

- To learn the basics of wireless adhoc network.
- To enhance working knowledge on Routing Protocols for Ad Hoc Wireless Networks.
- To understand Multi cast routing methods in Ad Hoc wireless networks.
- To Study Security Protocols for Ad Hoc Wireless Networks.
- To be familiar with energy Management in Ad Hoc Wireless Networks.

UNIT I INTRODUCTION 9

Ad Hoc Wireless Networks- Issues in Ad Hoc Wireless Networks, Ad Hoc Wireless Internet; MAC Protocols for Ad Hoc Wireless Networks-Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks - Classifications of MAC Protocols.

UNIT II ROUTING PROTOCOLS FOR AD HOC WIRELESS NETWORKS 9

Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks - Classifications of Routing Protocols - Power Aware Routing Protocols.

UNIT III MULTI CAST ROUTING IN AD HOC WIRELESS NETWORKS 9

Issues in Designing a Multicast Routing Protocol - Classifications of Multicast Routing Protocols – Energy Efficient Multicasting -Multicasting with Quality of Service Guarantees -Application Dependent Multicast Routing.

UNIT IV SECURITY PROTOCOLS FOR AD HOC WIRELESS NETWORKS 9

Security in Ad Hoc Wireless Networks -Network Security Requirements -Issues and Challenges in Security Provisioning- Network Security Attacks-Key Management-Secure Routing in Ad Hoc Wireless Networks.

UNIT V ENERGY MANAGEMENT IN AD HOC WIRELESS NETWORKS 9

Classification of Energy Management Schemes - Transmission Power Management Schemes, -System Power Management Schemes - Special topics in Ad-hoc and wireless networks.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- understand the basics of wireless adhoc network.
- enhanced working knowledge on routing protocols for ad hoc wireless networks.
- implement multi cast routing methods in ad hoc wireless network.
- apply security protocols for ad hoc wireless networks.
- gain knowledge on energy management in ad hoc wireless networks.

REFERENCES

1. C S. Ram Murthy, B. S. Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols”, Prentice Hall of India, 2nd ed. 2012.
2. R. Hekmat, “Ad hoc Networks: Fundamental Properties and Network Topologies”, Springer, 1st ed. 2006.
3. B. Tavli and W. Heinzelman, “Mobile Ad Hoc Networks: Energy Efficient Real Time Data Communications”, Springer, 1st ed. 2006.
4. G. Anastasi, E. Ancillotti, R. Bernasconi, and E. S. Biagioni, “Multi Hop Ad Hoc Newtorks from Theory to Reality”, Nova Science Publishers, 2008.
5. Daniel Minoli, “Wireless sensor networks”, Wiley, 2013.

PCS15E04 DATA VISUALIZATION TECHNIQUES 3 0 0 3

COURSE OBJECTIVES

- To learn visual perception and core skills for visual analysis
- To understand visualization for time-series analysis
- To study correlation analysis techniques.
- To know visualization for ranking, deviation and distribution analysis
- To acquire knowledge of dash board design

UNIT I CORE SKILLS FOR VISUAL ANALYSIS 9

Information visualization - effective data analysis - traits of meaningful data - visual perception -making abstract data visible -building blocks of information visualization - analytical interaction -analytical navigation -optimal quantitative scales-reference lines and regions -trellises and crosstabs -multiple concurrent views -focus and context - details on demand- over-plotting reduction- analytical patterns-pattern examples

UNIT II TIME-SERIES, RANKING, ANDDEVIATIONANALYSIS 9

Time-series analysis - time-series patterns - time-series displays - time-series best practices-part-to-whole and ranking patterns-part-to-whole and ranking displays-best practices - deviation analysis - deviation analysis displays - deviation analysis best practices

UNIT III DISTRIBUTION, CORRELATION, AND MULTIVARIATE ANALYSIS 9

Distribution analysis- describingdistributions-distributionpatterns-distributiondisplays- distribution analysis best practices - correlation analysis - describing correlations - correlation patterns - correlation displays - correlation analysis techniques and best practices-multivariate analysis- multivariate patterns-multivariate displays- multivariate analysis techniques and best practices

UNIT IV INFORMATION DASHBOARD DESIGN-I 9

Information dashboard -categorizing dashboards -typical dashboard data-dashboard design issues and best practices - visual perception- limits of short-term memory- visually encodingdata-Gestaltprinciples-principlesofvisualperceptionfordashboarddesign

UNIT V INFORMATION DASH BOARD DESIGN-II 9

Characteristics of dashboards -key goals in visual design process -dashboard display media – designing dashboards for usability - meaningful organization - maintaining consistency - aesthetics of dashboards - Testing for usability - case studies: sales dashboard, CIO dashboard, Telesales Data board, marketing analysis dashboard

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- understand principles of visual perception
- apply core skills for visual analysis
- apply visualization techniques for various data analysis tasks
- analyse multivariate patterns.
- design information dashboard

REFERENCES

1. Stephen Few, "Now you see it: Simple Visualization techniques for quantitative analysis", Analytics Press, 2009.
2. Stephen Few, "Information dashboard design: The effective visual communication of data",O'Reilly, 2006.
3. Edward R. Tufte, "The visual display of quantitative information", Second Edition, GraphicsPress,2001.
4. NathanYau, "Data Points: Visualization that means something", Wiley, 2013.
5. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.
6. EvanStubbs, "The value of business analytics: Identifying the path to profitability", Wiley, 2011.

PCS15E05 SPEECH PROCESSING AND SYNTHESIS 3 0 0 3

COURSE OBJECTIVES

- To study the fundamental concepts of speech processing.
- To design the solution of LPC equations.
- To learn various speech enhancement techniques.
- To know System pattern and Markov model for Speech recognition
- To acquire knowledge of homomorphic systems.

UNIT I INTRODUCTION TO SPEECH PROCESSING 9

Anatomy & Physiology of Speech Organs, The process of Speech Production, The Acoustic Theory of Speech Production, Digital models for speech signals. Window considerations, Short time energy and average magnitude Short time average zero crossing rate, Speech vs. silence discrimination using energy and zero crossing, Pitch period estimation using a parallel processing approach, The short time autocorrelation function, The short time average magnitude difference function, Pitch period estimation using the autocorrelation function

UNIT II LINEAR PREDICTIVE ANALYSIS 9

Basic principles of Linear Predictive Analysis: The Autocorrelation Method, The Covariance Method, Solution of LPC Equations: Cholesky Decomposition Solution for Covariance Method, Durbin's Recursive Solution for the Autocorrelation Equations, Pitch Detection and using LPC Parameters.

UNIT III HOMOMORPHIC SYSTEMS 9

Homomorphic Systems for Convolution: Properties of the Complex Cepstrum, Computational Considerations, The Complex Cepstrum of Speech, Pitch Detection, Formant Estimation, Mel frequency cepstrum computation.

UNIT IV SPEECH ENHANCEMENT TECHNIQUES AND PATTERN 9

Nature of interfering sounds, Speech enhancement techniques: spectral subtraction, Enhancement by resynthesis, Comb filter, Wiener filter. Basic pattern recognition approaches, parametric representation of speech, evaluating the similarity of speech patterns, isolated digit Recognition System, Continuous digit Recognition System.

UNIT V SPEECH RECOGNITION MODELS 9

Hidden Markov Model (HMM) for speech recognition, Viterbi algorithm, Training and testing using HMMs, Adapting to variability in speech (DTW), and Language models. Issues in speaker recognition and speech synthesis of different speakers. Text to speech conversion, Calculating acoustic parameters, synthesized speech output performance and characteristics of text to speech, Voice processing hardware and software architectures.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- build and apply speech processing in real models.
- analysis the speech recognition techniques.
- develop homomorphic systems.
- simulate speech recognition models.
- testing the speech processing models.

REFERENCES

1. L.R Rabiner and S.W. Schafer, “Digital processing of speech signals”, Pearson Education.
2. Douglas O'Shaughnessy, “Speech Communications: Human & Machine”, 2nd ed., IEEE Press.
3. Thomas F. Quateri, “Discrete Time Speech Signal Processing: Principles and Practice”, 1st ed., PE.
4. Ben Gold & Nelson Morgan, “Speech & Audio Signal Processing”, 1 ed., Wiley, 2012.
5. Claudio Becchetti and Lucio Prina Ricotti, “Speech Recognition”, Wiley.

ELECTIVE II

PCS15E06 STORAGE AREA NETWORKS 3 0 0 3

COURSE OBJECTIVES

- To learn the necessity for storage area networks
- To study the appropriateness of the different networked storage options for different applications
- To learn NAS – IP SAN.
- To understand the architecture of virtualization technologies.
- To understand the securing and managing storage Infrastructure.

UNIT I INTRODUCTION TO INFORMATION STORAGE AND MANAGEMENT – STORAGE SYSTEM ENVIRONMENT 9

Information Storage - Evolution of Storage Technology and Architecture - Data Center Infrastructure - Key Challenges in Managing Information - Information Lifecycle Components of Storage System Environment - Disk Drive Components - Disk Drive Performance - Fundamental Laws Governing Disk Performance - Logical Components of the Host - Application Requirements and Disk Performance.

UNIT II DIRECT-ATTACHED STORAGE–SCSI AND STORAGE AREA NETWORKS 9

Types of DAS – DAS Benefits and Limitations – Disk Drive Interfaces – Introduction to Parallel SCSI – Overview of Fibre Channel – The SAN and Its Evolution – Components of SAN – FC Connectivity – Fibre Channel Ports – Fibre Channel Architecture – Zoning – Fibre Channel Login Types – FC Topologies.

UNIT III NAS– IP SAN 9

General – Purpose Service vs. NAS Devices – Benefits of NAS – NAS File I / O – Components of NAS – NAS Implementations – NAS File-Sharing Protocols – NAS I/O Operations – Factors Affecting NAS Performance and Availability. iSCSI – FCIP.

UNIT IV CONTENT-ADDRESSED STORAGE– STORAGE VIRTUALIZATION 9

Fixed Content and Archives – Types of Archive – Features and Benefits of CAS – CAS Architecture – Object Storage and Retrieval in CAS – CAS Examples Forms of Virtualization – SNIA Storage Virtualization Taxonomy – Storage Virtualizations Configurations – Storage Virtualization Challenges – Types of Storage Virtualization.

UNIT V SECURING THE STORAGE INFRASTRUCTURE– MANAGING THE STORAGE INFRASTRUCTURE 9

Storage Security Framework – Risk Triad – Storage Security Domains – Security Implementations in Storage Networking Monitoring the Storage Infrastructure – Storage Management Activities – Storage Infrastructure Management Challenges – Developing an Ideal Solution.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- state the need for storage area networks.
- choose the best option for any given application environment.
- apply architecture of backup/recovery and virtualization technologies
- implement storage visualization methods.
- understand securing storage infrastructure.

REFERENCES

1. Ulf Troppens,Rainer Erkens and Wolfgang Muller, "Storage Networks Explained", John Wiley&Sons,2011.
2. Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill, 2008.
3. Tom Clark, "Designing Storage Area Networks: A practical reference for implementing fibre channel and IP SANs", Addison Wesley, 2003.
4. Mike Jackson "SAS Storage Architecture: Serial Attached SCSI", TMH, 2012.
5. Pankaj Sharma, "Information Storage and Management", Wiley, 2013.

PCS15E07 AD-HOC & SENSOR NETWORKS 3 0 0 3

COURSE OBJECTIVES

- To understand the design issues in ad hoc and sensor networks.
- To learn the different types of mac protocols.
- To be familiar with different types of ad-hoc routing protocols.
- To expose the TCP issues in ad-hoc networks.
- To learn the architecture and protocols of wireless sensor networks.

UNIT I INTRODUCTION 9

Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs) :concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.

UNIT II MULTICAST ROUTING 9

Classifications of Routing Protocols –Table–Driven Routing Protocols –Destination Sequenced Distance Vector (DSDV) –Wireless Routing Protocol (WRP) –Cluster Switch Gateway Routing (CSGR) –Source–Initiated On–Demand Approaches –Ad hoc On–Demand Distance Vector Routing (AODV) –Dynamic Source Routing (DSR) –Temporally Ordered Routing Algorithm (TORA) –Signal Stability Routing(SSR) –Location–Aided Routing (LAR) –Power–Aware Routing (PAR) –Zone Routing Protocol(ZRP)

UNIT III MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS 9

Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols- Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11

UNIT IV SENSOR NETWORKS ARCHITECTURE 9

Single node architecture –Hardware components, energy consumption of sensor nodes, Network architecture – Sensor network scenarios, types of sources and sinks, single hop versus multi-hop networks, multiple sinks and sources, design principles, Development of wireless sensor networks, physical layer and transceiver design consideration in wireless sensor networks, Energy usage profile, choice of modulation, Power Management

UNIT V ROUTING PROTOCOLS AND OPERATING SYSTEMS 9

Gossiping and agent-based uni-cast forwarding, Energy-efficient unicast, Broadcast and multicast,geographic routing, mobile nodes, Data-centric routing –SPIN, Directed Diffusion, Energy

awarerouting, Gradient-based routing –COUGAR, ACQUIRE, Hierarchical Routing – LEACH,PEGASIS, Location Based Routing – GAF, GEAR, Data aggregation –Various aggregation techniques. Introduction to TinyOS –NesC, Interfaces, modules, configuration, Programming inTinyOS using NesC, Emulator TOSSIM.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- understand the concepts of network architectures and applications of ad-hoc and wireless sensor networks
- analyse the protocol design issues of ad hoc and sensor networks
- design routing protocols for ad hoc and wireless sensor networks with respect to some protocol design issues
- evaluate the qos related performance measurements of ad hoc and sensor networks
- develop the routing protocols.

REFERENCES

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ", Prentice Hall Professional Technical Reference, 2008.
2. Carlos De Morais Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2006.
3. Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication – 2002.
4. Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2006
5. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, and Applications", John Wiley, 2007.
6. K.Akkaya and M.Younis, "A Survey of routing protocols in wireless sensor networks", Elsevier Adhoc Network Journal, Vol.3, no.3, pp. 325-349, 2005.

PCS15E08 CLUSTER AND GRID COMPUTING 3 0 0 3

COURSE OBJECTIVES

- To learn the genesis of grid computing
- To study grid network services.
- To acquire knowledge of cluster file system.
- To know the application of grid computing
- To understand the grid technology and tool kits to facilitate grid computing

UNIT I INTRODUCTION TO GRID COMPUTING 9

Building Blocks of Grid - Globus Toolkit, Information Services

UNIT II GRID NETWORK SERVICE 9

Data Management in Grid, QoS-Based Grid Network Service Discovery

UNIT III CLUSTER FILE SYSTEM 9

A Practical Global File System for Cluster and Grid computing - Data Replication Optimization in Grid Delivery Network

UNIT IV APPLICATIONS AND SECURITY 9

Grid Distributed Middleware and its Application - Grid Computing Security Mechanisms

UNIT V SEMANTICS 9

Semantic Monitoring and Discovery of the Grid Systems - Semantic-Oriented Metadata Management Model in Semantic Grid

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- understand basic grid computing concepts.
- apply their knowledge and skills in grid computing applications
- create a web services and grid services
- develop cluster file system in grid computing.
- use the grid computing tool kits in real time applications

REFERENCES

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, “Distributed and Cloud Computing, from Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.
2. Zhen Xiao, Weijia Song, And Qi Chen, ”Dynamic Resource Allocation Using Virtual Machines For Cloud Computing Environment”, IEEE Transactions on Parallel and Distributed Systems, Vol. 24, No. 6, June 2013

3. RajkumarBuyya, Christian Vecchiola, S.TamaraiSelvi, ‘Mastering Cloud Computing”, TMGH, 2013.
4. George Reese, “Cloud Application Architectures: Building Applications and Infrastructure in the Cloud” O'Reilly
5. SivadonChaisiri, Bu-Sung Lee, and DusitNiyato, “Optimization of Resource Provisioning Cost In Cloud Computing”, IEEE Transactions on Services Computing, Vol. 5, No. 2, April-June 2012.

PCS15E09 INFORMATION RETRIEVAL 3 0 0 3

COURSE OBJECTIVES

- To learn the information retrieval models and document text mining techniques.
- To be familiar with web search engine.
- To be exposed to link analysis.
- To understand hadoop and map reduce.
- To categorize clustering algorithms.

UNIT I INTRODUCTION 9

Introduction -History of IR- Components of IR – Issues –Open source Search engine Frameworks –The impact of the web on IR – The role of artificial intelligence (AI) in IR – IR Versus Web Search – Components of a Search engine- Characterizing the web.

UNIT II RETRIVAL OF INFORMATION 9

Space retrieval models- Term weighting – TF-IDF weighting- cosine similarity – Preprocessing – Inverted indices– Language Model based IR – Probabilistic IR –Latent Semantic Indexing.

UNIT III WEB SEARCH ENGINE 9

Web search overview, web structure, Web size measurement – search engine optimization spam – Web Search Architectures -Focused Crawling – web indexes – Near-duplicate detection – Index Compression –XML retrieval.

UNIT IV LINK ANALYSIS 9

Link Analysis –hubs and authorities – Page Rank and HITS algorithms -Searching and Ranking – Relevance Scoring and ranking for Web – Similarity – Hadoop & Map Reduce – Evaluation – Personalized search – Collaborative filtering and content-based recommendation of documents and products – handling "invisible" Web – Snippet generation, Summarization, Question Answering, Cross-Lingual Retrieval.

UNIT V CATEGORIZATION CLUSTERING ALGORITHMS 9

Organization and relevance feedback – Text Mining -Text classification and clustering – Categorization algorithms: naive Bayes; decision trees; and nearest neighbor – Clustering algorithms: agglomerative clustering; k-means; expectation maximization.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- design web search engine.

- use link analysis.
- use hadoop and map reduce.
- apply document text mining techniques.
- categorizing clustering algorithms.

REFERENCES

1. C. Manning, P. Raghavan, and H. Schütze, "Introduction to Information Retrieval", Cambridge University Press, 2008.
2. Ricardo Baeza -Yates and Berthier Ribeiro – Neto, "Modern Information Retrieval: The Concepts and Technology behind Search", 2nd Edition, ACM Press Books 2011.
3. Bruce Croft, Donald Metzler and Trevor Strohman, "Search Engines: Information Retrieval in Practice", 1st Edition Addison Wesley, 2009.
4. Mark Levene, "An Introduction to Search Engines and Web Navigation", 2nd Edition Wiley, 2010.
5. Felipe M.G.Franca, "Intelligent text categorization and clustering', springer, 2009.

PCS15E10 BIO INFORMATICS 3 0 0 3

COURSE OBJECTIVES

- To search information and visualize it.
- To learn various bioinformatics algorithms.
- To understand data mining techniques.
- To study various pattern matching techniques.
- To learn modelling and simulation methods.

UNIT I INTRODUCTORY CONCEPTS 8

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

UNIT II SEARCH ENGINES, VISUALIZATION AND ALGORITHMS 10

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

UNIT III STATISTICS AND DATA MINING 9

Statistical concepts – Microarrays – Imperfect Data – Randomness – Variability – Approximation – Interface Noise – Assumptions – Sampling and Distributions – Hypothesis Testing – Quantifying Randomness – Data Analysis – Tool selection statistics of Alignment – Clustering and Classification – Data Mining – Methods –Selection and Sampling – Pre-processing and Cleaning – Transformation and Reduction – Data Mining Methods – Evaluation – Visualization – Designing new queries – Pattern Recognition and Discovery – Machine Learning – Text Mining – Tools.

UNIT IV PATTERN MATCHING 9

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

UNIT V MODELING AND SIMULATION 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- have basic idea of bioinformatics.
- retrieve information using various algorithms and techniques.
- sequence the databases.
- implement pattern matching techniques.
- do modelling and simulation.

REFERENCES

1. S.C. Rastogi, “Bioinformatics- Concepts, Skills, and Applications”, CBS Publishing, 2003.
2. S. Ignacimuthu and S.J.,Basic “Bioinformatics”, Narosa Publishing House, 1995.
3. T K Attwood and D J parry, “Smith,Introduction to Bioinformatics”, 1st ed., Pearson Education,2005.
4. C S V Murthy, “Bioinformatics”, 1st ed., Himalaya Publishing House, 2003.
5. Stephen A. Krawetz and David D. Womble, “Introduction to Bioinformatics A Theoretical and Practical Approach”, Humana Press, 2003.
6. Hooman H. Rashidi, Lukas K. Buehler, “Bioinformatics Basics-Applications in Biological Science and Medicine”, CRC press, 2005.