SEMESTER I

PMA16102 APPLIED PROBABILITY AND STATISTICS 3 2 0 4

COURSE OBJECTIVES

- To introduce the basic concepts of one dimensional and two dimensional random variables.
- To provide information about estimation theory, correlation, regression and testing of hypothesis.
- To enable the students to use the concepts of multivariate normal distribution and principle components analysis.
- To learn different testing hypothesis.
- To analyse multivariate normal density.

UNIT I ONE DIMENSIONAL RANDOM VARIABLES 15

Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Functions of a Random Variable.

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 15

Joint distributions – Marginal and Conditional distributions – Functions of two dimensional random variables – Regression Curve – Correlation.

UNIT III ESTIMATION THEORY 15

Unbiased Estimators – Method of Moments – Maximum Likelihood Estimation - Curve fitting by Principle of least squares – Regression Lines.

UNIT IV TESTING OF HYPOTHESES 15

Sampling distributions - Type I and Type II errors - Tests based on Normal, t, Chi-Square and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

UNIT V MULTIVARIATE ANALYSIS 15

Random Vectors and Matrices - Mean vectors and Covariance matrices - Multivariate Normal density and its properties - Principal components Population principal components – Principal components from standardized variables

TOTAL: 75 PERIODS

COURSE OUTCOMES

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

- acquire the basic concepts of probability and statistical techniques for solving mathematical problems which will be useful in solving engineering problems.
- evaluate the strength of evidence from the sample and provide a framework for making determinations related to the population.
- understand the notation of the population distribution, sampling distributions.

- develop efficient algorithms for solving dynamic programming problems and acquire skills in handling situation involving random variable.
- evaluate the different testing hypothesis.

REFERENCES

1. Oliver C.Ibe, "Fundamentals of Applied probability and Random Process", Academic Press, (An imprint of Elsevier), 2010.
2. T.Veerarajan, "Probability, Statistics and Random Process",2nd edition, Tata McGraw-Hill, New Delhi 2008.
3. Johnson, R.A., and Gupta.C.B, Miller and Freund's Probability and Statistics for
4. Engineers,"11th Edition, Pearson Education, Asia 2011.
5. Taha, H.A., "Operations Research, An introduction", 10th edition, Pearson education, New Delhi, 2010.
6. Abraham, "Statistical Methods for Forecasting", wiley, 2010.

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16101 NEXT GENERATION NETWORKS 3 0 0 3

COURSE OBJECTIVES

- To learn the technical, economical and service advantages of next generation networks.
- To understand the role of IP Multimedia Sub-system (IMS), network attachment and admission control functions.
- To learn the basic architecture of a next generation network (NGN) with reference and to understand NGN services.
- To compare the various methods of providing connection-oriented services over a NGN with reference to MPLS, MPLS-TE.
- To learn the various NGN virtual network services with reference to VPNs.

UNIT I INTRODUCTION 9

Evolution of public mobile services - motivations for IP based services, Wireless IP network architecture – 3GPP packet data network architecture. Introduction to next generation networks - Changes, Opportunities and Challenges, Technologies, Networks, and Services, Next Generation Society, future Trends.

UNIT II IMS AND CONVERGENT MANAGEMENT 9

IMS Architecture - IMS services, QoS Control and Authentication, Network and Service management for NGN, IMS advantages, Next Generation OSS Architecture – standards important to oss architecture, Information framework, OSS interaction with IMS, NGN OSS function/ information view reference model, DMTF CIM.

UNIT III MPLS AND VPN 9

Technology overview –MPLS & QoS, MPLS services and components – layer 2 VPN, layer 2 internetworking, VPN services, signaling, layer 3 VPN –Technology overview, Remote Access and IPsec integration with MPLS VPN.

UNIT IV MULTICAST 9

MPLS Multicast VPN overview – Applications, examples, IPv6 and MPLS – Technology overview, Future of MPLS –Integrating IP and optical networks, Future layer 3 services, future layer 2 services.

UNIT V NGN MANAGEMENT 9

Network Management and Provisioning – Configuration, Accounting, performance, security, case study for MPLS, Future enhancements – Adaptive self-healing networks

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- evaluate mobile and IP based services.
- develop the NGN architecture and the underlying technologies with a focus on the network transport stratum from a network carrier perspective.

- identify the market incentives for NGN development, examined fundamental technologies required to realize the expected NGN functions especially in the transport stratum.
- implement NGN related issues.
- explore the principles and practice of legacy wireless networks.

REFERENCES

1. Thomas Plavyk, "Next generation Telecommunication Networks, Services and Management", Wiley & IEEE Press Publications, 2012.
2. Neill Wilkinson, "Next Generation Network Services", John Wiley Publications, 2002.
3. Monique J. Morrow, "Next Generation Networks", CISCO Press, 2007.
4. Robert Wood, "MPLS and Next Generation Networks: Foundations for NGN and Enterprise Virtualization", CISCO Press, 2006.
5. Ina Minie, Julian Lucek, "MPLS enabled Applications – Emerging developments and new technologies", 3rd edition, Wiley. 2011.

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16102 ADVANCED DATA STRUCTURES AND ALGORITHMS 3 0 0 3

COURSE OBJECTIVES

- To learn elementary data structures and the significance of writing efficient algorithms.
- To study data structures for concurrency.
- To study advanced data structures such as search trees, hash tables, heaps and operations on them.
- To understand the principles of efficient algorithm design.
- To learn various advanced algorithms.

UNIT I DATA STRUCTURES AND CONCURRENCY 9

Review of algorithm design and analysis – review of elementary data structures – data structures and concurrency – locking linked lists – coarse-grained synchronization – fine-grained synchronization – lazy synchronization – non-blocking synchronization – concurrent queues – bounded partial queues – unbounded lock-free queues – dual data structures – concurrent stacks – elimination back off stack

UNIT II SEARCH TREES, HASH TABLES AND STRINGS 9

Search Trees – Weight Balanced trees – Red Black trees – Finger Trees and level linking – Skip lists – joining and splitting balanced search trees – Hash trees – extendible hashing- Strings – tries and compressed tries – dictionaries – suffix trees – suffix arrays

UNIT III HEAPS 9

Heaps - Array-Based Heaps - Heap-Ordered Trees and Half-Ordered Trees - Leftist Heaps – Skew Heaps - Binomial Heaps - Changing Keys in Heaps - Fibonacci Heaps - Double-Ended Heap structures – multidimensional heaps.

UNIT IV ADVANCED CONCURRENT DATA STRUCTURES 9

Concurrent hashing – closed-address hash sets – lock-free hash sets – open-addressed hash sets – lock-based concurrent skip lists – lock-free concurrent skip lists – concurrent priority queues – bounded priority queue – unbounded priority queue – concurrent heap – skip list based unbounded priority queues.

UNIT V ADVANCED ALGORITHMS 9

Introduction to Approximation algorithms – job scheduling on a single machine – knapsack problem – minimizing weighted sum of completion time on a single machine – MAX SAT and MAX CUT. Introduction to Randomized algorithms – min cut. Introduction to parallel algorithms – parallel sorting algorithms.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- implement concurrent linked lists, stacks, and queues.
- perform operations in search trees, hash tables and strings
- understand different types of heap.
- apply data structures for strings and advanced concurrent structures.
- develop advanced parallel sorting algorithms.

REFERENCES

1. M. Herlihy and N. Shavit, “The Art of Multiprocessor Programming”, Morgan Kaufmann, 2012.
2. Peter Brass, “Advanced Data Structures”, Cambridge University Press, 2008.
3. Gavpai, “Data Structures and Algorithms – Concepts, techniques and Applications”, First Edition, Tata McGraw-Hill, 2008.
4. S.K. Chang, “Data Structures and Algorithms – Series of Software Engineering and Knowledge Engineering”, Vol. 13, World Scientific Publishing, 2003.
5. Jon Kleinberg, "Algorithm Design", Addison-Wesley, 2013.
6. David P. Williamson, David B. Shmoys, “The Design of Approximation Algorithms”, Cambridge University Press, 2011.
7. Michael J. Quinn, “Parallel Computing: Theory & Practice”, Tata McGraw Hill Edition, 2003.

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16103 **MULTICORE ARCHITECTURE** **3 0 0 3**

COURSE OBJECTIVES

- To understand the recent trends in the field of Computer Architecture.
- To identify architecture performance related parameters.
- To learn the need for parallel processing.
- To expose problems related to multiprocessing and embedded architectures.
- To understand the different types of multicore architectures.

UNIT I FUNDAMENTALS OF QUANTITATIVE DESIGN AND ANALYSIS 9

Classes of Computers– Trends in Technology, Power, Energy and Cost– Dependability– Measuring, Reporting and Summarizing Performance–Quantitative Principles of Computer Design–Classes of Parallelism- ILP, DLP, TLP and RLP-Multithreading-SMT and CMP Architectures–Limitations of Single Core Processors-The Multicore era –Case Studies of Multicore Architectures.

UNIT II DLP INVECTOR, SIMD AND GPU ARCHITECTURES 9

Vector Architecture-SIMD Instruction Set Extensions for Multimedia–Graphics Processing Units-Detecting and Enhancing Loop Level Parallelism-SIMD, MIMD Performance-Case Studies.

UNIT III TLP AND MULTIPROCESSORS 9

Symmetric and Distributed Shared Memory Architectures– Cache Coherence Issues- Performance Issues– Synchronization Issues–Models of Memory Consistency- Interconnection Networks–Buses, Cross bar and Multi-stage Interconnection Networks Simple Program Multiple Data.

UNIT IV RLP AND DLP INWARE HOUSE-SCALE ARCHITECTURES 9

Programming Models and Workloads for Warehouse-Scale Computers –Architectures for Warehouse-Scale Computing – Physical Infrastructure and Costs – Cloud Computing – Case Studies.

UNIT V ARCHITECTURES FOR EMBEDDED SYSTEMS 9

Features and Requirements of Embedded Systems –Signal Processing and Embedded Applications–The Digital Signal Processor–Embedded Multiprocessors -Case Studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- identify the limitations of ILP and the need for multicore architectures
- discuss the issues related to multiprocessing and suggest solutions
- point out the salient features of different multicore architectures and how they exploit parallelism
- analyse the different types of inter connection networks critically.
- discuss the architecture of GPUs, warehouse-scale computers and embedded processors

REFERENCES

1. John L.Hennessey and David A. Patterson, "Computer Architecture –A Quantitative Approach", Morgan Kaufmann/Elsevier, 5th edition, 2012.
2. KaiHwang, "Advanced Computer Architecture", Tata McGraw- Hill Education, 2003.
3. Richard Y. Kain, "Advanced Computer Architecture a Systems Design Approach", Prentice Hall, 2011.
4. David E.Culler, Jaswinder Pal Singh, "Parallel Computing Architecture: A Hardware / Software Approach", Morgan Kaufmann/ Elsevier, 1997.
5. Govindarajalu.B, " Computer Architecture and Organization: Design principles and applications", Tata McGraw- Hill Education, 2014.

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16104 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 in 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 this course, the students 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.

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16105 MACHINE LEARNING TECHNIQUES 3 0 0 3

COURSE OBJECTIVES

- To learn the concepts of machine learning.
- To understand linear and non-linear learning models.
- To apply distance-based clustering techniques.
- To build tree and rule based models.
- To apply reinforcement learning techniques.

UNIT I FOUNDATIONS OF LEARNING 9

Components of learning– learning models–geometric models– probabilistic models– logic models–grouping and grading– learning versus design–types of learning–supervised– unsupervised–reinforcement–theory of learning– feasibility of learning–error and noise– training versus testing–theory of generalization – generalization bound–approximation- generalization tradeoff–bias and variance–learning curve

UNIT II LINEAR MODELS 9

Linear classification – univariate linear regression – multivariate linear regression – regularized regression – Logistic regression –perceptions–multilayer neural networks – learning neural networks structures–support Vector machines– soft margin SVM– going beyond linearity–generalization and over fitting– regularization– validation

UNIT III DISTANCE-BASEDMODELS 9

Nearest neighbour models–K-means–clustering around medoids –silhouettes– hierarchical clustering–k-dtrees–locality sensitive hashing–non-parametric regression–ensemble learning– bagging and random forests– boosting–meta learning

UNIT IV TREE AND RULEMODELS 9

Decision trees – learning decision trees – ranking and probability estimation trees –regressiontrees– clusteringtrees–learningorderedrulelists–learningunorderedrulelists–descriptiverulelearning– associationrulemining– first-order rule learning

UNIT V REINFORCEMENT LEARNING 9

Passive reinforcement learning–direct utility estimation– adaptive dynamic programming– temporal-difference learning – active reinforcement learning – exploration –learning an action-utility function – Generalization in reinforcement learning – policy search – application sin game playing– applications in robot control

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- understand theory of underlying machine learning.
- construct algorithms to learn linear and non-linear models.
- implement data clustering algorithms.

- construct algorithms to learn tree and rule-based models.
- apply reinforcement learning techniques.

REFERENCES

1. Y.S.Abu-Mostafa, M.Magdon-Ismail, and H.-T.Lin, "Learning from Data", AML Book Publishers, 2012.
2. K.P.Murphy, "Machine Learning: A probabilistic perspective", MIT Press, 2012.
3. C.M.Bishop, "Pattern Recognition and Machine Learning", Springer, 2007.
4. D. Barber, "Bayesian Reasoning and Machine Learning", Cambridge University Press, 2012.
5. M.Mohri, A.Rostamizadeh, and A.Talwalkar, "Foundations of Machine Learning", MITPress, 2012.
6. T.M.Mitchell, "Machine Learning", McGraw-Hill, 1997.
7. S.Russel and P.Norvig, "Artificial Intelligence: A Modern Approach", Third Edition, Prentice Hall, 2009.

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16106 ADVANCED DATA STRUCTURES AND ALGORITHMS LABORATORY 0 0 4 2

COURSE OBJECTIVES

- To learn implementation of data structures for concurrency
- To study implementation of advanced data structures such as search trees, hash tables, heaps and operations on them
- To implement advanced concurrent data structures
- To apply the principles of efficient algorithm design and learn various advanced algorithms

Each student has to work individually on assigned lab exercises. Lab sessions could be scheduled as one contiguous three-hour session per week. The students have to complete a minimum of 12 exercises. It is recommended that all implementations are carried out in Java. If C or C++ has to be used, then the threads library will be required for concurrency.

Implementation and applications of classic linear data structures, namely, linked lists, queues, and stacks.

1. Implementation of various locking and synchronization mechanisms for concurrent linked lists, concurrent queues, and concurrent stacks.
2. Implementation of weight balanced search trees and skip lists.
3. Implantation of suffix trees and pattern matching
4. Implementation of various heap structures.
5. Implementation of concurrent hashing, concurrent skip lists, and concurrent priority queues.
6. Implementation of approximation and randomized algorithms.
7. Implementation of parallel sorting algorithms.
8. Developing an application involving concurrency and data structures.

TOTAL PERIODS: 60

COURSE OUTCOMES

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

- implement concurrent linked lists, stacks, and queues.
- apply operations on different types of heaps and design techniques for advanced algorithms.
- implement and apply data structures for strings and advanced concurrent structures.
- implement advanced concurrent data structures.

REFERENCES

1. M. Herlihy and N. Shavit, “The Art of Multiprocessor Programming”, Morgan Kaufmann, 2012.
2. Peter Brass, “Advanced Data Structures”, Cambridge University Press, 2008.
3. Gavpai, “Data Structures and Algorithms – Concepts, techniques and Applications”, First Edition, Tata McGraw-Hill, 2008.
4. S.K. Chang, “Data Structures and Algorithms – Series of Software Engineering and Knowledge Engineering”, Vol. 13, World Scientific Publishing, 2003.
5. Jon Kleinberg, "Algorithm Design", Addison-Wesley, 2013.

CO/PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes(POs)**												**Programme Specific Outcomes (PSOs)**	
	PO1	**PO 2**	**PO3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PS O1**	**PS O2**
CO1	3	1	1	-	1	-	-	-	-	-	-	-	3	3
CO2	2	1	2	-	2	-	1	-	-	-	-	-	1	3
CO3	3	2	-	-	3	-	-	-	-	-	-	-	-	3
CO4	3	1	-	-	-	2	-	-	-	-	-	-	1	3

SEMESTER II

PCE16201 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 in 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 this course, the students 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

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
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CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16202 ADVANCED DATABASES AND INFORMATION SYSTEMS 3 0 0 3

COURSE OBJECTIVES

- To acquire knowledge in parallel and distributed databases and its applications.
- To study the usage and applications of object oriented database
- To understand the principles of intelligent databases.
- To understand the usage of advanced data models.
- To learn the emerging databases such as XML, cloud , big data and information systems

UNIT I PARALLEL AND DISTRIBUTED DATABASES 9

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems –Parallel Databases: I/O Parallelism –Inter and Intra Query Parallelism –Inter and Intra operation Parallelism – Design of Parallel Systems- Distributed Database Concepts - Distributed Data Storage – Distributed Transactions –Commit Protocols –Concurrency Control –Distributed Query Processing–Case Studies.

UNIT II OBJECT AND OBJECT RELATIONAL DATABASES 9

Concepts for Object Databases: Object Identity–Object structure –Type Constructors – Encapsulation of Operations – Methods –Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model–ODL– OQL–Object Relational and Extended–Relational Systems: Object Relational features in SQL/Oracle–Case Studies.

UNIT III INTELLIGENT DATABASES 9

Active Databases: Syntax and Semantics(Starburst,Oracle,DB2)-Taxonomy-Applications- Design Principles for Active Rules-Temporal Databases: Overview of Temporal Databases- TSQL2- Deductive Databases: Logic of Query Languages – Data log- Recursive Rules- Syntax and Semantics of Data log Languages- Implementation of Rules and Recursion- Recursive Queries in SQL-Spatial Databases-Spatial Data Types-Spatial Relationships- Spatial Data Structures-Spatial Access Methods-Spatial DB Implementation.

UNIT IV ADVANCED DATA MODELS 9

Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control -Transaction Commit Protocols- Multimedia Databases- Information Retrieval-Data Warehousing-Data Mining-Text Mining.

UNIT V EMERGING TECHNOLOGIES AND INFORMATION SYSTEMS 9

XML Databases- Web Databases- Geographic Information Systems-Biological Data Management-Cloud Based Databases- Big Data-Storage. Information System - Critical Characteristics of Information, NSTISSC Security Model-Components of an Information System, Securing the Components, Balancing Security and Access.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- select the appropriate high performance database like parallel and distributed database.
- model and represent the real world data using object oriented database.
- design a semantic based database to meaningful data access.
- embed the rule set in the database to implement intelligent databases.
- represent the data using XML database for better interoperability.

REFERENCES

1. R.Elmasri, S.B.Navathe, "Fundamentals of Database Systems", Fifth Edition, Pearson Education /Addison Wesley, 2007.
2. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Third Edition, 2007.
3. Henry F Korth, Abraham Silberschatz, S.Sudharshab, "Database System Concepts", Fifth Edition, Mc Graw Hill, 2006.
4. C.J.Date, A.Kannanand S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
5. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", Mc Graw Hill, Third Edition, 2004.

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16203 AD- HOC AND WIRELESS NETWORKS 3 0 0 3

COURSE OBJECTIVES

- To learn the basics of wireless ADHOC network.
- To enhance knowledge in routing protocols for ADHOC wireless networks.
- To understand multi cast routing methods in ADHOC wireless networks.
- To study security protocols for ADHOC wireless networks.
- To gain knowledge on energy management in ADHOC 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 this course, the students will be able to

- understand the basics of wireless ADHOC network.
- enhance knowledge in 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.

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16204 **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 this course, the students 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.
- understand 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. 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.

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16205 **CLOUD COMPUTING LABORATORY** **0 0 4 2**

COURSE OBJECTIVES

- To learn the implementation of cloud computing and architecture
- To know the concepts of Hadoop
- To learn the implementation of map reduce
- implementation of cloud computing and architecture

LIST OF EXPERIMENTS

Use Eucalyptus or Open Nebula or equivalent to set up the cloud and demonstrate:

1. Study of Cloud Computing & Architecture.
2. Find procedure to run the virtual machine of different configuration. Check how many virtual machines can be utilized at particular time.
3. Study and implementation of Infrastructure as a Service and Study and installation of Storage as Service.
4. Implementation of identity management.
5. Find procedure to attach virtual block to the virtual machine and check whether it holds the data even after the release of the virtual machine.
6. Install a C compiler in the virtual machine and execute a sample program.
7. Show the virtual machine migration based on the certain condition from one node to the other.
8. Find procedure to install storage controller and interact with it.
9. Find procedure to set up the one node Hadoop cluster.
10. Mount the one node Hadoop cluster using FUSE.
11. Write a program to use the API's of Hadoop to interact with it.
12. Write a word count program to demonstrate the use of Map and Reduce tasks.
13. Mini project.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- use the grid and cloud tool kits.
- design and implement applications on the grid.
- design and implement applications on the cloud.
- Design and implementation of cloud computing and architecture

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. 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.

CO/PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes(POs)**												**Programme Specific Outcomes (PSOs)**	
	PO1	**PO 2**	**PO3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PS O1**	**PS O2**
CO1	3	1	1	-	1	-	-	-	-	-	-	-	3	3
CO2	2	1	2	-	2	-	1	-	-	-	-	-	1	3
CO3	3	2	-	-	3	-	-	-	-	-	-	-	-	3
CO4	3	1	-	-	-	2	-	-	-	-	-	-	1	3

PCE16206 TECHNICAL REPORT PREPARATION AND PRESENTATION 0 0 4 2

COURSE OBJECTIVES

- To provide exposure to the students to refer, read and review the research articles in referred journals and conference proceedings.
- To expose the presentation skill of the students.
- To improve the technical report writing skills of the students.
- read and review the research articles in referred Journals and conference proceedings.

COURSE OUTCOMES

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

- understand how to refer, read and review the research articles.
- gain knowledge in presenting technical papers in national and international conferences.
- write a technical paper in the referred journals and conference proceedings.
- technical papers in national and international conferences.

TOTAL PERIODS: 60

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

SEMESTER III

PCE16301 SOFTWARE ARCHITECTURE 3 0 0 3

COURSE OBJECTIVES

- To understand the architectural requirements
- To identify the architectural structures.
- To develop the architectural documentation.
- To generate the architectural alternatives.
- To evaluate the architecture against the drivers.

UNIT I ARCHITECTURAL DRIVERS 9

Introduction – Standard Definitions of Software Architecture– Architectural structures – Influence of software architecture on organization – Architecture Business Cycle – Functional requirements – Technical constraints Quality Attributes – Quality Attribute Workshop (QAW) – Documenting Quality Attributes – Six part scenarios.

UNIT II ARCHITECTURAL VIEWS AND DOCUMENTATION 9

Introduction – Standard Definitions for views – Structures and views- Perspectives: Static, dynamic and physical and the accompanying views – Representing views-available notations – Good practices in documentation– Documenting the Views using UML – Merits and Demerits of using visual languages – Need for formal languages Architectural Description Languages – ACME.

UNIT III ARCHITECTURAL STYLES 9

Introduction – Data flow styles – Call-return styles – Shared Information styles – Event styles – Case studies for each style.

UNIT IV ARCHITECTURAL DESIGN 9

Approaches for architectural design – System decomposition – Attributes driven for specific quality design – Architecting attributes – Performance, Availability – Security – Architectural conformance.

UNIT V ARCHITECTURE EVALUATION AND SOME SPECIAL TOPICS 9

Need for evaluation – Scenario based evaluation against the drivers – ATAM and its variations – Case studies in architectural evaluations – SOA and Web services – Cloud Computing – Adaptive structure

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the key architectural drivers and the influence of architecture on business and technical activities.
- adopt good practices for documenting the architecture.
- develop alternative architectures for a given problem.
- use formal languages to specify architecture
- describe the recent trends in software architecture.

TEXT BOOKS

1. Len Bass, Paul Clements, and Rick Kazman, “Software Architectures Principles and Practices”, 2nd Edition, Addison-Wesley, 2003.
2. Anthony J Lattanze, “Architecting Software Intensive System. A Practitioner's Guide”, Auerbach Publications, 2010.

REFERENCES

1. Paul Clements, Felix Bachmann, Len Bass, David Garlan, James Ivers, Reed Little, Paulo Merson, Robert Nord, and Judith Stafford, “Documenting Software Architectures. Views and Beyond”, 2nd Edition, Addison-Wesley, 2010.
2. Paul Clements, Rick Kazman, and Mark Klein, “Evaluating software architectures: Methods and case studies.” Addison-Wesley, 2001.
3. RajkumarBuyya, James Bromberg, and AndrzejGoscinski, “Cloud Computing. Principles and Paradigms”, John Wiley & Sons, 2011.

WEB LINKS

1. https://www.tutorialspoint.com
2. https://www.cs.cmu.edu/afs/cs/project/tinker-arch
3. https://www.codementor.io

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16302 NETWORK AND INFORMATION SECURITY 3 0 0 3

COURSE OBJECTIVES

- To familiarize the fundamentals of Cryptography
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity
- To realize the various key distribution and management schemes
- To understand how to deploy encryption techniques to secure data in transit across data networks.
- To design security applications in the field of Information technology.

UNIT I INTRODUCTION 9

An Overview of Computer Security- Security Services- Security Mechanisms-Security Attacks- Access Control Matrix, Policy- Security policies, Confidentiality policies, Integrity policies and Hybrid policies.

UNIT II CRYPTOSYSTEMS &AUTHENTICATION 9

Classical Cryptography-Substitution Ciphers - permutation Ciphers - Block Ciphers - DES - Modes of Operation - AES - Linear Crypt analysis, Differential Cryptanalysis - Hash Function - SHA512 – Message Authentication Codes - HMAC - Authentication Protocols.

UNIT III PUBLIC KEY CRYPTOSYSTEMS **9**

Introduction to Public key Cryptography- Number theory- The RSA Cryptosystem and Factoring Integer-Attacks on RSA -The ELGamal Cryptosystem- Digital Signature Algorithm-Finite Fields- Elliptic Curves Cryptography-Key management- Session and Interchange keys ,Key exchange and generation-PKI

UNIT IV SYSTEM IMPLEMENTATION 9

Design Principles, Representing Identity, Access Control Mechanisms ,Information Flow and Confinement Problem - Secure Software Development: Secured Coding - OWASP/SANS Top Vulnerabilities – Buffer Overflows- Incomplete mediation - XSS - Anti Cross Site Scripting Libraries- - Canonical Data Format - Command Injection-Redirection-Inference-Application Controls

UNIT V NETWORK SECURITY 9

Secret Sharing Schemes-Kerberos- Pretty Good Privacy(PGP)-Secure Socket Layer(SSL)- Intruders- HIDS-NIDS-Firewalls-Viruses.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- estimate the performance and throughput of a given network
- design a network aimed at optimum performance
- identify and analyses security problems in networks.
- apply appropriate security techniques to solve security problems
- understand the legal, copyright and privacy issues.

TEXT BOOKS

1. Menezes Bernard, "Network Security and Cryptography", Cengage Learning, New Delhi,2011
2. William Stallings, "Cryptography and Network Security: Principles and Practices", Third Edition, Pearson Education, 2006.

REFERENCES

1. Matt Bishop, "Computer Security art and science ", Second Edition, Pearson Education, 2002
2. Wade Trappe and Lawrence C. Washington, "Introduction to Cryptography with Coding Theory" Second Edition, Pearson Education,2007
3. Jonathan Katz, and Yehuda Lindell, Introduction to Modern Cryptography, CRC Press, 2007
4. Douglas R.Stinson, "Cryptography Theory and Practice", Third Edition, Chapman & Hall/CRC,2006

WEBLINKS

1. www.youlinux.com
2. http://xml.coverpages.org/OWASP-TopTen.pdf

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

ELECTIVE I

PCE16151 DIGITAL IMAGE PROCESSING AND ANALYSIS 3 0 0 3

COURSE OBJECTIVES

- To understand image models and its 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 this course, the students will be able to

- implement spatial, frequency filter operations.
- know the 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.

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
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CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16152 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 this course, the students 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.

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16153 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 in 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 this course, the students 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.

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

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CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16154 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 this course, the students will be able to

- build and apply speech processing in real models

- analysis the speech recognition techniques
- develop homomorphic systems
- simulate speech recognition models
- test 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.

Mapping of Course Outcomes with Programming Outcomes
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CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

ELECTIVE II

PCE16251 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 this course, the students 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.

Mapping of Course Outcomes with Programming Outcomes
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CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16252 **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 application environments
- 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 this course, the students will be able to

- understand 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.

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

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CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16352 **REALTIME SYSTEMS** **3 0 0 3**

COURSE OBJECTIVES

- To provide good understanding of fundamental concepts in real time systems..
- To realize the advanced topics and areas in real time systems
- To understand the basic multi-task scheduling algorithms for periodic and sporadic tasks as well as understand the impact of the latter woon scheduling.
- To expose the capabilities of commercial off-the-shelf R-T kernel
- To expose to real time communications and databases.

UNIT I INTRODUCTION **9**

Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Deadlines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

UNIT II REAL TIME SCHEDULING **9**

Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective- Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling A periodic and Sporadic jobs in Priority Driven and Clock Driven Systems.

UNIT III RESOURCES SHARING **9**

Effect of Resource Contention and Resource Access Control (RAC), Non-pre-emptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority- Ceiling Protocol, Use of Priority - Ceiling Protocol in Dynamic Priority Systems, Pre-emption Ceiling Protocol, Access Control in Multiple-Unit Resources, Controlling Concurrent Accesses to Data Objects.

UNIT IV REAL TIME COMMUNICATION **9**

Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols.

UNIT V REAL TIME OPERATING SYSTEMS AND DATABASE **9**

Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of Temporal data, Temporal Consistency, Concurrency Control, Overview of Commercial Real Time databases

TOTAL PERIODS 45

COURSE OUTCOMES

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

- know the basics and importance of real-time systems.
- create a high-level analysis document based on requirements specifications
- make a high-level design document based on analysis documentation
- generate the test and validation plan based on requirements specification based on documentation
- understand capabilities of at least one commercial off-the-shelf r-t kernel.

TEXT BOOKS

1. Real Time Systems by Jane W. S. Liu, Pearson Education Publication.

REFERENCES

1. Mall Rajib, "Real Time Systems", Pearson Education.
2. Albert M. K. Cheng, "Real-Time Systems: Scheduling, Analysis, and Verification", Wiley.

WEBLINKS

1. http://www.realtime-info.be/
2. http://www.eg3.com/navi/real.html
3. http://www.realtime-info.be/encyc/techno/publi/faq/rtos_faq_table.html

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
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CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16353 **COMPUTER VISION** **3 0 0 3**

COURSE OBJECTIVES

- To review image processing techniques for computer vision
- To be aware of shape and region analysis
- To understand Hough Transform and its applications to detect lines, circles, ellipses
- To realize three-dimensional image analysis techniques
- To recognize motion analysis for 3 dimensional objects

UNIT I IMAGE PROCESSING FOUNDATIONS 9

Review of image processing techniques - classical filtering operations - thresholding techniques –edge detection techniques - corner and interest point detection-mathematical morphology-texture.

UNIT II SHAPES AND REGIONS 9

Binary shape analysis -connectedness -object labelling and counting -size filtering - distance functions – skeleton and thinning - deformable shape analysis - boundary tracking procedures-active contours-shape models and shape recognition- centroidal profiles-handling occlusion-boundary length measures-boundary descriptors-chain codes-Fourier descriptors-region descriptors- moments

UNIT III HOUGH TRANSFORM 9

Line detection -Hough Transform (HT) for line detection -foot-of-normal method -line localization -line fitting-RANSAC for straight line detection -HT based circular object detection -accurate center location -speed problem ellipse detection -Case study: Human Iris location - hole detection - generalized Hough Transform (GHT) – spatial matched filtering-GHT for ellipse detection- object location-GHT for feature collation.

UNIT IV 3D VISION AND MOTION 9

Methods for 3D vision - projection schemes - shape from shading - photometric stereo- shape from texture - shape from focus - active range finding -surface representations - point- based representation-volumetric representations-3D object recognition - 3D reconstruction -introduction to motion-triangulation -bundle adjustment -translational alignment – parametric motion - spline-based motion- optical flow-layered motion.

UNIT V APPLICATIONS 9

Application: Photo album - Face detection - Face recognition - Eigen faces - Active appearance and 3D shape offices Application: Surveillance -fore ground-back ground separation -particle filters -Chamfer matching ,tracking, and occlusion-combining views from multiple cameras - human gait analysis Application: In-vehicle vision system: locating roadway - road markings -identifying road signs-locating pedestrians

TOTAL PERIODS 45

COURSE OUTCOMES

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

- put into practice fundamental image processing techniques required for computer vision
- perform shape and region analysis
- realize boundary tracking techniques
- apply 3d vision techniques
- implement motion related techniques and develop applications using computer vision techniques

REFERENCES

1. E.R.Davies, "Computer &Machine Vision", Fourth Edition, Academic Press, 2012.
2. R.Szeliski, "Computer Vision: Algorithms and Applications", Springer 2011.
3. Simon J.D.Prince, "Computer Vision: Models, Learningand Inference", Cambridge UniversityPress, 2012.
4. Mark Nixonand Alberto S.Aquado, "Feature Extraction & Image Processing for Computer Vision", Third Edition, Academic Press, 2012.
5. D.L.Baggioetal, "Mastering Open CV with Practical Computer Vision Projects", Packt Publishing, 2012.
6. Jan Erik Solem," Programming Computer Vision with Python: Tools and algorithms for analyzing images", O'Reilly Media, 2012.

WEB LINKS

1. http://nptel.ac.in/courses/106105032/
2. http://nptel.ac.in/courses/117105079/
3. http://www.nptelvideos.in/2012/12/digital-image-processing.html

Mapping of Course Outcomes with Programming Outcomes
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CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16354 **RESEARCH METHODOLOGY** **3 0 0 3**

COURSE OBJECTIVES

- To develop a hypothesis, a research problem and related questions.
- To frame the problem with the correct research methodology.
- To collect data that accurately addresses the research problem.
- To use data to make decisions.
- To evaluating feasibility of research proposals.

UNIT I INTRODUCTION **9**

The nature of CS research - what is research? - Project planning, tools and techniques for planning – Literature searches, information gathering.

UNIT II PROJECT DEVELOPMENT **9**

Reading and understanding research papers - Project implementation and IT project management. – Presentation skills, written and oral - Time management- Team working.

UNIT III OPTIMIZATION METHODS **9**

Linear Programming: Simplex method – Dynamic Programming – Integer Programming - Hill climbing.

UNIT IV 3D VISION AND MOTION **9**

Simulated annealing - Quantum annealing - Genetic algorithms - Ant colony optimization - Particle swarm optimization - Tabu search - Beam search.

UNIT V APPLICATIONS **9**

Commercial and economic considerations in the IT industry - Review of Legal, Ethical, Social and Professional (LSEP) issues, such as data protection, hacking, etc. - Technical writing, referencing, bibliographies.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- prepare a preliminary research design for projects in their subject matter areas .
- accurately collect, analyze and report data .
- present complex data or situations clearly.
- produce optimized project outcome.
- review and analyze research findings that affect their agency.

REFERENCES

1. C. W. Dawson, The Essence of Computer Projects: A Student Guide. New Delhi: PHI, 2006.
2. Duane A. Bailey, A Letter to Research Students. Massachusetts.
3. Humdy Taha, Operation Research. New Delhi: PHI, 2007.
4. S. Kirkpatrick and C. D. Gelatt and M. P. Vecchi. Optimization by Simulated Annealing, Science, Vol 220, 1983, 671-680.
5. B. Apolloni, N. Caravalho and D. De Falco. Quantum stochastic optimization, Stochastic Processes and their Applications, Vol. 33, 1989, 233-244.

6. David E. Goldberg. Genetic Algorithms in Search, Optimization, and Machine Learning, New Delhi : New Age, 1989.

WEB LINKS

1. http://nptel.ac.in/courses/107108011/
2. http://nptel.ac.in/syllabus/107108011/
3. http://www.nptel.ac.in/syllabus/121106001/

Mapping of Course Outcomes with Programming Outcomes **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak**														
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CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16355 DESIGN AND ANALYSIS OF PARALLEL ALGORITHMS 3 0 0 3

COURSE OBJECTIVES

- To learn various models of parallel algorithms
- To understand the performance of parallel computation
- To expose the students to parallel sorting and merging algorithms
- To understand the various concept of parallel searching algorithm
- To analyse parallel algorithms

UNIT I INTRODUCTION 9

Sequential model, need of alternative model, parallel computational models such as PRAM, LMCC, Hypercube, Cube Connected Cycle, Butterfly, Perfect Shuffle Computers, Tree model, Pyramid model, Fully Connected model, PRAM-CREW, EREW models, simulation of one model from another one.

UNIT II PERFORMANCE MEASURES OF PARALLEL ALGORITHMS 9

Performance Measures of Parallel Algorithms, speed-up and efficiency of PA, Cost- optimality, An example of illustrate Cost- optimal algorithms- such as summation, Min/Max on various models.

UNIT III PARALLEL SORTING NETWORKS 9

Parallel Sorting Networks, Parallel Merging Algorithms on CREW/EREW/MCC, Parallel Sorting Networks on CREW/EREW/MCC/, linear array.

UNIT IV PARALLEL SEARCHING ALGORITHM 9

Parallel Searching Algorithm, Kth element, Kth element in X+Y on PRAM, Parallel Matrix Transportation and Multiplication Algorithm on PRAM, MCC, Vector-Matrix Multiplication, Solution of Linear Equation, Root finding.

UNIT V PARALLEL GRAPH ALGORITHM 9

Graph Algorithms - Connected Graphs, search and traversal, Combinatorial Algorithms- Permutation, combinations, Derangements.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- identify the need for parallel algorithms
- discuss the classification of parallel architectures and identify suitable programming models
- perform sorting on CREW, EREW models
- implement optimized searching and sorting algorithms
- apply parallel graph algorithms to find real time solutions

REFERENCES

1. M.J. Quinn, “Designing Efficient Algorithms for Parallel Computer”, McGrawHill.
2. S.G. Akl, “Design and Analysis of Parallel Algorithms”.
3. Jaja, “Introduction to Parallel algorithms”, Pearson, 1992.
4. S.G. Akl,”Parallel Sorting Algorithm” by Academic Press.

WEB LINKS

1. http://nptel.ac.in/courses/106106112/
2. http://nptel.ac.in/syllabus/106106112/
3. http://nptel.ac.in/courses/106104120/Assignment.pdf

Mapping of Course Outcomes with Programming Outcomes **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak**														
COs	**Programme Outcomes(POs)**												**Programme Specific Outcomes (PSOs)**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

ELECTIVE IV

PCE16451 MODEL CHECKING AND PROGRAM VERIFICATION 3 0 0 3

COURSE OBJECTIVES

- To understand automata model
- To analyse LTL, CTL, and CTL*
- To understand timed automata, TCTL, and PCTL
- To analyse verification of deterministic and recursive programs
- To expose verification of object-oriented programs, parallel, distributed, and non-deterministic programs

UNIT I AUTOMATA AND TEMPORAL LOGICS 9

Automata on finite words-model checking regular properties-automata on infinite words- Buchi automata – Linear Temporal Logic (LTL) - automata based LTL model checking - Computational Tree Logic (CTL) - CTL model Checking - CTL*model checking.

UNIT II TIMED AND PROBABILISTIC TREELOGICS 9

Timed automata - timed computational tree logic (TCTL) - TCTL model checking - probabilistic systems - Probabilistic computational tree logic (PCTL) - PCTL model checking - PCTL*- Markov decision processes.

UNIT III VERIFYING DETERMINISTIC AND RECURSIVE PROGRAMS 9

Introduction to program verification -verification of "while" programs -partial and total correctness – verification of recursive programs -case study: binary search -verifying recursive programs with parameters.

UNIT IV VERIFYING OBJECT-ORIENTED AND PARALLEL PROGRAMS 9

Partial and total correctness of object - oriented programs - case study: Insertion in linked lists - verification of disjoint parallel programs -verifying programs with shared variables- case study: parallel zero search-verification of synchronization -case study: the mutual exclusion problem.

UNIT V VERIFYING NON-DETERMINISTIC AND DISTRIBUTED PROGRAMS 9

Introduction to non-deterministic programs - partial and total correctness of non- deterministic programs-case study: The Welfare Crook Problem- syntax and semantics of distributed programs-verification of distributed programs -case study: A Transmission Problem-introduction to fairness.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- do model checking using LTL
- make model checking using CTL
- perform and compare model checking using TCTL and PCTL
- verify deterministic and recursive programs
- verify object-oriented programs, parallel, distributed, and non-deterministic programs

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4. M.Ben-Ari, "Principles of the SPIN Model Checker", Springer, 2008.
5. K.R.Apt, F.S.deBoer, E.-R.Olderogand A.Pnueli, "Verification of Sequential andConcurrent Programs", third Edition, Springer, 2010.
6. M.Huth and M.Ryan,"Logic in Computer Science-Modeling and Reasoning about Systems", Second Edition,Cambridge University Press, 2004.
7. B.Berardetal, "Systems and Software Verification: Model-checking techniques and tools", Springer, 2010.

WEBLINKS

1. https://www.mimuw.edu.pl/~vbarany/TL_course.html
2. http://why.lri.fr/manual/manual003.html
3. http://www.inf.ed.ac.uk/teaching/courses/propm/papers/CTL.html

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16452 **ROBOTICS** **3 0 0 3**

COURSE OBJECTIVES

- To expose the students about the fundamentals of robotic systems
- To understand the concepts of actuators and controls of Robot
- To know about 2D & 3D transformations and its uses
- To expose the knowledge of Cell Design of Robot and its usage in various application
- To learn working principles of Micro /Nano Robotics through various techniques

UNIT I INTRODUCTION **9**

Robot anatomy - Definition, law of robotics, History and Terminology of Robotics - Accuracy and repeatability of Robotics - Simple problems Specifications of Robot-Speed of Robot - Robot joints and links-Robot classifications Architecture of robotic systems - Robot Drive systems Hydraulic, Pneumatic and Electric system.

UNIT II END EFFECTORS AND ROBOT CONTROLS **9**

Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type- Magnetic grippers- Vacuum grippers - Air operated grippers-Gripper force analysis - Gripper design-Simple problems - Robot controls- point to point control, Continuous path control, Intelligent robot-Control system for robot joint- Control actions – Feedback Devices - Encoder, Resolver, LVDT-Motion Interpolations-Adaptive control.

UNIT III ROBOT TRANSFORMATIONS AND SENSORS **9**

Robot kinematics – Types - 2D, 3D Transformation - Scaling, Rotation, Translation - Homogeneous coordinates, multiple transformation-Simple problems. Sensors in robot – Touch sensors-Tactile sensor – Proximity and range sensors – Robotic vision sensor-Force sensor-Light sensors, Pressure sensors.

UNIT IV ROBOT CELL DESIGN AND APPLICATIONS **9**

Robot work cell design and control - Sequence control, Operator interface, Safety monitoring devices in Robot - Mobile robot working principle, actuation using MATLAB, NXT Software Introductions - Robot applications Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting and undersea Robot.

UNIT V MICRO/NANO ROBOTICS SYSTEM **9**

Micro/Nano robotics system overview - Scaling effect - Top down and bottom up approach - Actuators of Micro/ Nano robotics system – Nano robot communication techniques-Fabrication of micro/Nano grippers-Wall climbing micro robot working principles - Biomimetic robot-Swarm robot – Nano robot in targeted drug delivery system.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- know the basics of robot
- understand end effectors and robot controls
- gain knowledge about robot transformations and sensors
- design robot cell applications
- understand micro/nano robotic systems

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1. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education., 2009
2. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012
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5. P.A. Janaki Raman, Robotics and Image Processing an Introduction, Tata McGraw Hill Publishing company Ltd., 1995.
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8. Craig. J. J. "Introduction to Robotics mechanics and control", Addison- Wesley, 1999.
9. Ray Asfahl. C., "Robots and Manufacturing Automation", John Wiley & Sons Inc., 1985.

WEBLINKS

1. http://robotframework.org/robotframework/latest/RobotFramework.html
2. https://www.youtube.com/watch?v=T0SK5A1rwdk
3. https://www.youtube.com/watch?v=o3IhGZY0TCE

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
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CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16453 **BIO - INSPIRED COMPUTING** **3 0 0 3**

COURSE OBJECTIVES

- To understand Cellular Automata and artificial life
- To study artificial neural networks and its evolution
- To learn developmental and artificial& biological immune systems
- To realize behavioral systems especially in the context of Robotics
- To recognize collective systems such as ACO,PSO and swarm robotics

UNIT I EVOLUTIONARYAND CELLULARSYSTEMS 9

Foundations of evolutionary theory – Genotype – artificial evolution – genetic with representations – initial population – fitness functions – selection and reproduction– genetic operators – evolutionary measures –evolutionary algorithms –evolutionary electronics – evolutionary algorithm case study: Cellular systems – cellular automata – modelling with cellular systems – other cellular systems – computation cellular systems –artificial life –analysis and synthesis of cellular systems.

UNIT II NEURALSYSTEMS 9

Biological nervous systems–artificial neural networks –neuron models –architecture –signal encoding– synaptic plasticity– unsupervised learning– supervised learning– reinforcement learning–evolution of neural networks– hybrid neural systems–case study

UNIT III DEVELOPMENTAL AND IMMUNESYSTEMS 9

Rewritingsystems–synthesisofdevelopmentalsystems–evolutionaryrewritingsystems– evolutionary applications developmental programs Biological immune systems – lessons for artificial immune systems – algorithms and –shape space –negative selection algorithm –clonal selection algorithm - examples.

UNIT IV BEHAVIORALSYSTEMS 9

Behaviour is cognitive science – behaviour in AI – behaviour based robotics – biological inspiration for robots–robots as biological models– robot learning–evolution of behavioural systems– learning in behavioural systems– co-evolution of body and control– towards self-reproduction–simulation and reality

UNIT V COLLECTIVE SYSTEMS 9

Biological self-organization –Particle Swarm Optimization (PSO)–ant colony optimization (ACO) – swarm robotics – co-evolutionary dynamics – artificial evolution of competing systems–artificial Evolution of cooperation–case study.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- implement and apply evolutionary algorithm
- explain cellular automata and artificial life
- implement and apply neural system
- explain developmental, artificial immune systems and explain behavioural systems
- implement and apply collective intelligence systems

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1. D.Floreanoand C.Mattiussi,"Bio-InspiredArtificialIntelligence", MITPress, 2008.
2. F. Neumann and C .Witt, " Bio inspired Computation in combinatorial optimization: Algorithms and their computational complexity", Springer, 2010.
3. A.E.ElbenandJ.E.Smith,"IntroductiontoEvolutionaryComputing",Springer,2010.
4. Simon O. Haykin, "Neural Networks and Learning Machines", Third Edition, Prentice Hall, 2008.

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1. https://www.youtube.com/watch?v=vxibD6VaOfI
2. https://www.neurobs.com/
3. https://www.youtube.com/watch?v=Fr7NRaxNDh0

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
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CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16454 PATTERN RECOGNITION AND ANALYSIS 3 0 0 3

COURSE OBJECTIVES

- To know about supervised and unsupervised learning
- To study about feature extraction and structural pattern recognition.
- To explore different classification models.
- To understand hidden markov models.
- To understand fuzzy pattern classifiers and perception.

UNIT I PATTERN CLASSIFIER 9

Overview of Pattern recognition – Discriminant functions – Supervised learning – Parametric estimation – Maximum Likelihood Estimation – Bayesian parameter Estimation – Problems with Bayes approach – Pattern classification by distance functions – Minimum distance pattern classifier.

UNIT II CLUSTERING 9

Clustering for unsupervised learning and classification – Clustering concept – C Means algorithm - Hierarchical clustering – Graph theoretic approach to pattern Clustering – Validity of Clusters.

UNIT III FEATURE EXTRACTION AND STRUCTURAL PATTERN RECOGNITION 9

KL Transforms – Feature selection through functional approximation – Binary selection - Elements of Formal grammars - Syntactic description - Stochastic grammars - Structural representation.

UNIT IV HIDDEN MARKOV MODELS AND SUPPORT VECTOR MACHINE 9

State Machines – Hidden Markov Models – Training – Classification – Support vector Machine – Feature Selection.

UNIT V RECENT ADVANCES 9

Fuzzy logic – Fuzzy Pattern Classifiers – Pattern Classification using Genetic Algorithms – Case Study Using Fuzzy Pattern Classifiers and Perception.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- classify the data and identify the patterns.
- analyze the pattern clustering and its validity.
- extract feature set and select the features from given data set.
- identify the hidden markov models.
- understand the advances in fuzzy pattern classifiers.

REFERENCES

1. M. Narasimha Murthy and V. Susheela Devi, “Pattern Recognition”, Springer 2011.
2. S.Theodoridis and K.Koutroumbas, “Pattern Recognition”, 4th Ed., Academic Press, 2009
3. Robert J.Schalkoff, “Pattern Recognition Statistical, Structural and Neural Approaches”, John Wiley & Sons Inc., New York, 1992.
4. C.M.Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.

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WEB LINKS

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2. http://videolectures.net/Top/Computer_Science/Machine_Learning/Pattern_Recognition/
3. http://www.learnerstv.com/Free-engineering-Video-lectures-ltv832-Page1.htm

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
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CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16455 **MULTIMEDIA SYSTEMS** **3 0 0 3**

COURSE OBJECTIVES

- To learn various operations in multimedia and its uses.
- To recognize the various components of multimedia and the standards
- To realize various multimedia systems used in real time world.
- To study about the multimedia tools and its usage
- To understand how to develop multimedia application

UNIT I INTRODUCTION **9**

Introduction – Multimedia presentation and production – Characteristics – Multiple media – Utilities – Uses – Promotion – Creation – Digital representation – Multimedia architecture.

UNIT II COMPONENTS OF MULTIMEDIA **9**

Text: Text compression - file formats – Image – Audio – Video: Transmission of video signals- Television Broadcasting standards - Digital video standards – Animation: Key frames and Tweening – Principles of animation– 3D animation – file formats– Multimedia documents.

UNIT III MULTIMEDIA SYSTEMS **9**

Visual display systems: Video adapter card – Video adapter cable – Optical storage media – CD technology– DVD technology – Compression: CODEC – Types and techniques – GIF image coding standards –Lossy /Perceptual – JPEG – MPEG-1– MPEG-2 – Fractals.

UNIT IV MULTIMEDIA TOOLS **9**

Authoring Tools: features and types – Card and page based tools – Icon and object based tools – Time based tools – Cross platform authoring notes – Basic software tools: OCR software – 3D modeling and animation tools.

UNIT V MULTIMEDIA APPLICATION DEVELOPMENT **9**

Software life cycle – ADDIE model – Conceptualization – Content collection and processing – Story – Flow line – Script – Storyboard – Implementation – Authoring metaphors – Testing and feedback – Final delivery – Report writing/ documentation – Case study: Web application – Console application – Distributed application – Mobile application – Games consoles – itv – Kiosks

TOTAL PERIODS 45

COURSE OUTCOMES

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

- study of basic multimedia concepts and architecture.
- understand of various multimedia components technology and animation
- understand of multimedia system concepts
- uses of multimedia tools
- applications of multimedia in web and mobile environment.

REFERENCES

1. R. Parekh, Principles of Multimedia, New Delhi: Tata McGraw-Hill, 2010.
2. Tay Vaughan, Multimedia: Making It Work, New Delhi: McGraw-Hill Professional, 2007.
3. Ralf Steinmetz and Klara Nahrstedt, Multimedia: Computing, Communications and Applications, New Delhi: Pearson Education, 2012.
4. Fred Halsall, Multimedia Communication-Application Networks, Protocols and Standard, Singapore: Addison -Wesley, 2008.

WEB LINKS

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2. https://www.w3schools.com/html/html_media.asp
3. http://docs.worldviz.com/vizard/Tutorial_Multimedia_(Video,_Audio).html

Mapping of Course Outcomes with Programming Outcomes
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COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
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CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2