

SEMESTER I

PMA15102

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 1 ONE DIMENSIONAL RANDOM VARIABLES 9+6

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 2 TWO DIMENSIONAL RANDOM VARIABLES 9+6

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

UNIT 3 ESTIMATION THEORY 9+6

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

UNIT 4 TESTING OF HYPOTHESES 9+6

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 5**MULTIVARIATE ANALYSIS****9+6**

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 PERIODS: : 45+30=75**COURSE OUTCOMES**

At the end of the course the student 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 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 Engineers,” 11th Edition, Pearson Education, Asia 2011.
4. Taha, H.A., “Operations Research, An introduction”, 10th edition, Pearson education, New Delhi, 2010.
5. 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



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 1 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 2 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 3 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 4 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.

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

TOTAL PERIODS: 45

COURSE OUTCOMES

At the end of the course the student 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 Plavky, “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.

WEB LINKS

1. <https://www.itu.int>
2. <https://mnet.cs.nthu.edu>
3. <https://www.researchgate.net>

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



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 1 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 2 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 3 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 4 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 5 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 PERIODS: 45

COURSE OUTCOMES

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

- Implement concurrent linked lists, stacks, and queues.
- Perform operations on 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.

WEB LINKS

1. <http://www.geeksforgeeks.org/pattern-searching-set-8-suffix-tree-introduction/>
2. <http://www.cs.au.dk/~gerth/slides/soda98.pdf>
3. <http://www.cs.sunysb.edu/~algorith/files/suffix-trees.shtml>

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(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



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 1 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 2 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 3 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 4 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 5 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 PERIODS: 45

COURSE OUTCOMES

At the end of the course the student 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
- Critically analyse the different types of inter connection networks
- 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.



WEB LINKS

1. <http://www.cs.cmu.edu/~fp/courses/15213-s07/lectures/27-multicore.pdf>.
2. <http://rolfed.com/nehalem/nehalemPaper.pdf>.
3. <http://accel.cs.vt.edu/files/lecture2.pdf>.

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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

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 1 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 2 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 3 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 4 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 5 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 PERIODS: 45

COURSE OUTCOMES

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

- Recognize the strengths and limitations of cloud computing.
- Identify the architecture, infrastructure and delivery models of cloud computing Applications.
- Suggest solutions for the core issues of cloud computing such as security, privacy and interoperability.
- Decide the appropriate technologies, algorithms and approaches for the related issues.
- Deal security challenges in cloud environment.

REFERENCES

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.
2. Ronald L. Krutz, Russell Dean Vines, “Cloud Security – A comprehensive Guide to Secure Cloud Computing”, Wiley – India, 2010.
3. John W.Rittinghouse and James F.Ransome, “Cloud Computing: Implementation, Management, and Security”, CRC Press, 2010.
4. George Reese, “Cloud Application Architectures: Building Applications and Infrastructure in the Cloud”, O'Reilly
5. 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.

WEB LINKS

1. <http://www.buyya.com/papers/CloudSim 2010.pdf>
2. <http://thecloudtutorial.com/>.
3. <http://www.netmagicsolutions.com/cloud-infrastructure-services>

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



COURSE OBJECTIVES

- To learn the concepts of machine learning.
- To implement 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 1 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 2 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 3 DISTANCE-BASED MODELS 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 4 TREE AND RULE MODELS 9

Decision trees – **learning decision trees** – ranking and probability estimation trees –regression trees– clustering trees–learning ordered rule lists–learning unordered rule lists–descriptive rule learning– association rule mining– first-order rule learning

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 PERIODS: 45

COURSE OUTCOMES

At the end of the course the student 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.

WEB LINKS

1. <http://stattrek.com/regression/regression-example.aspx>.
2. <http://onlinestatbook.com/2/regression/intro.html>.
3. http://www.metacademy.org/graphs/concepts/generalized_linear_models.

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CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	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 learn to implement advanced concurrent data structures
- To learn to apply 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 the course the student 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.

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.

WEB LINKS

1. <http://www.w3schools.in/c-programming-language>.
2. <http://www.geeksforgeeks.org/pattern-searching-set-8-suffix-tree-introduction>.

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

3. <http://iamwww.unibe.ch/~wenger/DA/SkipList>.



SEMESTER II

PCE15201

SOFT COMPUTING

3 0 0 3

COURSE OBJECTIVES

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

UNIT 1 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 2 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 3 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 4 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 5 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 PERIODS: 45

COURSE OUTCOMES

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

- Identify and describe soft computing techniques and their roles in building intelligent machines.
- Recognize the feasibility of applying a soft computing methodology for a particular problem.
- Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
- Develop genetic algorithm based applications.
- Acquire knowledge in evolutionary computing environment.

REFERENCES

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

5. Ross Timothy J, “Fuzzy Logic with Engineering Applications”, Wiley India Pvt Ltd, New Delhi, 2010

WEB LINKS

1. http://www.doc.ic.ac.uk/~nd/surprise_96/journal/vol4/cs11/report.html
2. <http://www.seattlerobotics.org/encoder/mar98/fuz/flindex.html>
3. <http://www.obitko.com/tutorials/genetic-algorithms/ga-basic-description.php>

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	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	2	3	3	-	-	-	-	-	-	-	2	1	3
CO5	2	3	3	-	-	2	-	-	-	-	-	3	3	2



COURSE OBJECTIVES

- To acquire knowledge on 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 emerging databases such as XML, Cloud , Big Data and information systems

UNIT 1 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 2 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 3 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 4 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 5 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 PERIODS: 45

COURSE OUTCOMES

At the end of the course the student 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.

WEB LINKS

1. <http://ocw.mit.edu/courses>.
2. www.mu.ac.in/...dvanced%20Database%20Techniques-f.pdf.
3. www.debtechint.com/advanced_modeling.htm.

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



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 1 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 2 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 3 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 4 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 5

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 PERIODS: 45

COURSE OUTCOMES

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

- Work in big data platform and its analysis techniques.
- Design efficient algorithms for mining the data from large volumes.
- Model a framework for Human Activity Recognition.
- Analyze the big data for useful business applications.
- Implement search methods and Visualization.

REFERENCES

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

WEB LINKS

1. <http://bigdatauniversity.com>
2. <http://developer.yahoo.com/hadoop/tutorial/module1.html>
3. <http://infolab.stanford.edu/~ullman/mmds/ch4.pdf>

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



COURSE OBJECTIVES

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

UNIT 1 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 2 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 3 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 4 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 5**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 PERIODS: 45**COURSE OUTCOMES**

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

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

REFERENCES

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

WEB LINKS

1. <http://deneb.cs.kent.edu/~mikhail/classes/aos.f02/>.

2. <http://www.coda.cs.cmu.edu/ljpaper/lj.html>.
3. http://www.windowsnetworking.com/articles_tutorials/Windows2003-Distributed-File-System.html.

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



COURSE OBJECTIVES

- To learn various database techniques.
- To work with XML and other web databases.
- To work with weka tool.
- To operations insert, modify,delete and search operations.

LIST OF EXPERIMENTS

1. Create a relational database using B+ tree structure. Implement the operations insert, modify, delete and search operations with query parser.
2. Implement query optimizer by accessing the Meta data.
3. Create a distributed database and run various queries. Use stored procedures.
4. Queries using Object Oriented Database.
5. Parallel Database Access from a Programming Language
 - Access database from a programming language such as Java and Python.
6. Active Databases
 - Create an Active Database including Triggers and assertions.
7. Deductive Database
 - Create a knowledge database with facts and extract data using rules.
8. XML
 - Create an XML Schema for the Company Database.
9. Weka
 - Work with Weka tool classification and clustering algorithms.
10. Building Web Applications
 - Build Web applications using Java servlet API.

TOTAL PERIODS: 60**COURSE OUTCOMES**

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

- Implement the techniques of various databases
- Work in Weka tool
- operations insert, modify,delete and search operations
- Weka tool classification and clustering algorithms

WEB LINKS

1. <http://www.w3schools.in/c-programming-language>.
2. <http://www.geeksforgeeks.org/pattern-searching-set-8-suffix-tree-introduction/>.
3. <http://iamwww.unibe.ch/~wenger/DA/SkipList/>.

CO/PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
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CO2	2	1	2	-	2	-	1	-	-	-	-	-	1	3
CO3	3	2	-	-	3	-	-	-	-	-	-	-	-	3
CO4	3	1	-	-	-	2	-	-	-	-	-	-	1	3

