UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY, CHENNAI 600 025

REGULATIONS - 2013

M.E. COMPUTER SCIENCE AND ENGINEERING

I – IV SEMESTER CURRICULUM AND SYLLABUS

PROGRAM OBJECTIVES:

1. Prepare students to review and understand foundational Concepts in Computer Science and Engineering
2. Enable students to critically analyze current trends and learn future issues from a system perspective at multiple levels of detail and abstraction
3. Enable students to apply the interplay between theory and practice for problem solving using case studies
4. Enable students to continue to pursue lifelong multidisciplinary learning as professional engineers and scientists and effectively communicate technical information, function effectively on teams, and develop and apply computer engineering solutions within a global, societal, and environmental context
5. Prepare students to critically analyze existing literature in an area of specialization and develop innovative and research oriented methodologies to tackle gaps identified.

PROGRAM OUTCOMES

Students will be able to:

a. Apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems of varying complexity
b. Critically analyze a problem, identify, formulate and solve problems in the field of computer science and Engineering considering current and future trends
a. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, health and safety, and sustainability in the field of computer engineering
b. Function effectively on teams to accomplish a common goal
c. Communicate effectively with a range of audiences and prepare technical documents and make effective oral presentations
d. Analyze the local and global impact of computing on individuals, organizations, and society
e. Recognize the need for and possess an ability to engage in lifelong learning continuing professional development
f. Use current techniques, skills, and tools necessary for computing practice
g. Demonstrate advanced knowledge of a selected area within the computer science discipline
h. Critically analyze existing literature in an area of specialization and develop innovative and research oriented methodologies to tackle gaps identified.

UNIVERSITY DEPARTMENTS
ANNA UNIVERSITY, CHENNAI 600 025
REGULATIONS - 2013
M.E. COMPUTER SCIENCE AND ENGINEERING (FT & PT)
I - IV SEMESTER CURRICULUM AND SYLLABUS

SEMESTER I

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
CP8101	Multi-Core Architecture	3	0	0	3
CP8151	Advanced Data Structures and Algorithms	3	0	2	4
CP8152	Object Oriented Systems Engineering	**3**	**0**	**2**	**4**
CP8153	Open Source Systems and Networking	3	0	0	3
MA8154	Advanced Mathematics for Computing	3	1	0	4
PRACTICAL					
CP8111	Professional Practice	0	0	2	1
	TOTAL	**15**	**1**	**6**	**19**

SEMESTER II

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
CP8201	Advances in Compiler Design	3	0	0	3
CP8202	Machine Learning Techniques	3	0	2	4
CP8251	Virtualization Techniques	3	0	2	4
IF8254	Mobile and Pervasive Computing	3	0	0	3
	Elective I	3	0	0	3
	Elective II	3	0	0	3
PRACTICAL					
CP8211	Case Study	0	0	2	1
CP8212	Technical Seminar	0	0	2	1
	TOTAL	**18**	**0**	**8**	**22**

SEMESTER III

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
CP8351	Security Principles and Practices	3	0	0	3
	Elective III	3	0	0	3
	Elective IV	3	0	0	3
	Elective V	3	0	0	3
PRACTICAL					
CP8311	Project Work Phase I	0	0	12	6
	TOTAL	**12**	**0**	**12**	**18**

SEMESTER IV

COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICALS					
CP8411	Project Work Phase II	0	0	24	12
	TOTAL	**0**	**0**	**24**	**12**

UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY, CHENNAI 600 025

REGULATIONS - 2013

M.E. COMPUTER SCIENCE AND ENGINEERING (PART TIME)

I – VI SEMESTER CURRICULUM AND SYLLABUS

SEMESTER I

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
MA8154	Advanced Mathematics for Computing	3	1	0	4
CP8151	Advanced Data Structures and Algorithms	3	0	2	4
CP8101	Multi-Core Architecture	3	0	0	3
PRACTICAL					
CP8111	Professional Practice	0	0	2	1
	TOTAL	**9**	**1**	**4**	**12**

SEMESTER II

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
CP8251	Virtualization Techniques	3	0	2	4
CP8202	Machine Learning Techniques	3	0	2	4
	Elective I	3	0	0	3
PRACTICAL					
CP8212	Technical Seminar	0	0	2	1
	TOTAL	**9**	**0**	**6**	**12**

SEMESTER III

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
CP8152	Object Oriented Systems Engineering	**3**	**0**	**2**	**4**
CP8153	Open Source Systems and Networking	3	0	0	3
	Elective II	3	0	0	3
PRACTICAL					
CP8211	Case Study	0	0	2	1
	TOTAL	**9**	**0**	**4**	**11**

SEMESTER IV

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
IF8254	Mobile and Pervasive Computing	3	0	0	3
CP8201	Advances in Compiler Design	3	0	0	3
	Elective III	3	0	0	3
	Elective IV	3	0	0	3
	TOTAL	**12**	**0**	**0**	**12**

SEMESTER V

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
CP8351	Security Principles and Practices	3	0	0	3
	Elective V	3	0	0	3
PRACTICAL					
CP8311	Project Work Phase I	0	0	12	6
	TOTAL	**6**	**0**	**12**	**12**

SEMESTER VI

COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL					
CP8411	Project Work Phase II	0	0	24	12
	TOTAL	**0**	**0**	**24**	**12**

TOTAL NO. OF CREDITS : 71

ELECTIVE LIST (CSE)

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY BASED					
CP8001	Advanced Computing	3	0	0	3
CP8002	Computational Game theory	3	0	0	3
CP8003	Computational Geometry	3	0	0	3
CP8004	Parallel Algorithms	3	0	0	3
CP8005	Parallel Systems	3	0	0	3
SYSTEMS BASED					
CP8006	Fault Tolerant Systems	3	0	0	3
CP8007	Network Protocols	3	0	0	3
CP8074	Real Time System Design	3	0	0	3
IF8083	Unix Internals	3	0	0	3
SYSTEMS INTELLIGENT BASED					
CP8008	Bio Informatics	3	0	0	3
CP8009	Bio-Inspired Artificial Intelligence	3	0	0	3
CP8010	Cognitive Science	3	0	0	3
CP8011	Information Retrieval Techniques	3	0	0	3
CP8012	Internet of Things	3	0	0	3
CP8013	Network on Chip	3	0	0	3
CP8014	Secure Network System Design	3	0	0	3
CP8015	Text Data Mining	3	0	0	3
CP8016	Web Data mining	3	0	0	3
CP8073	Data Mining Techniques	3	0	0	3
CP8075	Social Network Analysis	3	0	0	3
IF8078	Image Processing	3	0	0	3
INFORMATION SYSTEMS BASED					
CP8017	AD HOC and Wireless Sensor Networks	3	0	0	3
CP8018	Big Data Analytics	3	0	0	3
CP8019	Ethical Hacking and Digital Forensics	3	0	0	3
CP8020	Parallel and Distributed Databases	3	0	0	3
CP8021	Statistical Natural Language Processing	3	0	0	3
CP8022	Web Services	3	0	0	3
CP8071	Advanced Database Administration and Tuning	3	0	0	3
IF8252	Cloud Computing **Technologies**	3	0	0	3

CP8101 **MULTI-CORE ARCHITECTURE** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the recent trends in the field of Computer Architecture and identify performance related parameters
- To appreciate the need for parallel processing
- To expose the students to the problems related to multiprocessing
- To understand the different types of multicore architectures
- To understand the design of the memory hierarchy
- To expose the students to multicore programming

UNIT I NEED FOR MULTICORE ARCHITECTURES 9

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

UNIT II MULTIPROCESSOR ISSUES 9

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

UNIT III MULTICORE ARCHITECTURES 9

Homogeneous and Heterogeneous Architectures – Intel Multicore Architectures – SUN CMP architecture – IBM Cell Architecture – GPGPU Architectures.

UNIT IV MEMORY HIERARCHY DESIGN 9

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

UNIT V MULTICORE PROGRAMMING 9

Parallel Programming models – Shared Memory Programming – Message Passing Interface – Open MP Program Development and Performance Tuning.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the 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
- Critically analyze the different types of inter connection networks
- Design a memory hierarchy and optimize it
- Explain the different parallel programming models
- Develop programs using Open MP and optimize them

REFERENCES:

1. John L. Hennessey and David A. Patterson, " Computer Architecture – A Quantitative Approach", Morgan Kaufmann / Elsevier, 5th. edition, 2012.
2. Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan Kaufmann / Elsevier, 2011.
3. Michael J Quinn, Parallel Programming in C with MPI and OpenMP, Tata McGraw Hill, 2003.
4. Darryl Gove, "Multicore Application Programming: For Windows, Linux, and Oracle Solaris", Pearson, 2011.
5. David E. Culler, Jaswinder Pal Singh, "Parallel Computing Architecture : A Hardware/ Software Approach" , Morgan Kaufmann / Elsevier, 1997.

CP8151 ADVANCED DATA STRUCTURES AND ALGORITHMS L T P C
3 0 2 4

OBJECTIVES:

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

UNIT I FUNDAMENTALS 9

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

UNIT II HEAP STRUCTURES 9

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

UNIT III SEARCH STRUCTURES 9

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

UNIT IV GEOMETRIC ALGORITHMS 9

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

UNIT V PARALLEL ALGORITHMS 9

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

TOTAL : 45 +30 : 75 PERIODS

OUTCOMES:

- Basic ability to analyze algorithms and to determine algorithm correctness and time efficiency class.
- Master a variety of advanced data structures and their implementations.
- Master different algorithm design techniques in computational geometry and in parallel algorithms.
- Ability to apply and implement learned algorithm design techniques and data structures to solve problems.

REFERENCES:

1. E. Horowitz, S. Sahni and Dinesh Mehta, Fundamentals of Data structures in C++, University Press, 2007.
2. G. Brassard and P. Bratley, Algorithmics: Theory and Practice, Printice –Hall,1988.
3. Mark de Berg, Otfried Cheong, Marc van Kreveld, Mark Overmars, Computational Geometry Algorithms and Applications, Third Edition, 2008
4. James A. Storer, An Introduction to Data Structures and Algorithms, Springer, New York, 2002.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein Introduction to Al,2009.

CP8152 OBJECT ORIENTED SYSTEMS ENGINEERING L T P C
3 0 2 4

OBJECTIVE:

- To understand the importance of object oriented software engineering.
- To study the various lifecycle models for developing software's.
- To analyze and design software using tools.
- To develop efficient software, deploy and maintain after production.

UNIT I CLASSICAL PARADIGM 9+6

System Concepts – Project Organization – Communication – Project Management

UNIT II PROCESS MODELS 9+6

Life cycle models – Unified Process – Iterative and Incremental – Workflow – Agile Processes

UNIT III ANALYSIS 9+6

Requirements Elicitation – Use Cases – Unified Modeling Language, Tools – Analysis Object Model (Domain Model) – Analysis Dynamic Models – Non-functional requirements – Analysis Patterns

UNIT IV DESIGN 9+6

System Design, Architecture – Design Principles - Design Patterns – Dynamic Object Modeling – Static Object Modeling – Interface Specification – Object Constraint Language

UNIT V IMPLEMENTATION, DEPLOYMENT AND MAINTENANCE 9+6

Mapping Design (Models) to Code – Testing - Usability – Deployment – Configuration Management – Maintenance

TOTAL: 45 + 30 = 75 PERIODS

OUTCOMES:

- To prepare object oriented design for small/ medium scale problem.
- To evaluate the appropriate life cycle model for the system under consideration.
- To apply the various tools and patterns while developing software
- Testing the software against usability, deployment, maintenance.

REFERENCES:

1. Bernd Bruegge, Alan H Dutoit, Object-Oriented Software Engineering, 2nd ed, Pearson Education, 2004.
2. Craig Larman, Applying UML and Patterns 3rd ed, Pearson Education, 2005.
3. Stephen Schach, Software Engineering 7th ed, McGraw-Hill, 2007.
4. Ivar Jacobson, Grady Booch, James Rumbaugh, The Unified Software Development Process, Pearson Education, 1999.
5. Alistair Cockburn, Agile Software Development 2nd ed, Pearson Education, 2007.

CP8153 OPEN SOURCE SYSTEMS AND NETWORKING L T P C
3 0 0 3

OBJECTIVES:

- To understand the basic issues in open source kernels
- To appreciate the different aspects of processes
- To understand the role played by files and devices
- To understand the basic issues in open source networking
- To appreciate the different aspects of internetworking

UNIT I FOUNDATION 9

Introduction – Memory addressing – Processes – Interrupts and exceptions – Kernel synchronization – clock and timer circuits.

UNIT II PROCESSES 9

Process scheduling: policy, algorithm, system calls – Memory management: page frame management, memory area management, slab allocator, aligning objects in memory, noncontiguous memory area management, addresses of noncontiguous memory areas – Process address space: process's address space, foundational aspects of memory regions, page fault exception handler, creation and deletion – System calls – Signals: foundational aspects of the role of signals, generating a signal, delivering a signal and system calls – Implementation aspects of processes.

UNIT III FILES AND DEVICES 9

Virtual File System – I/O architecture and device drivers, block devices handling, the generic block layer, block device drivers – Implementation aspects of files and devices.

UNIT IV NETWORKING 9

Introduction, data structures overview, user space to kernel interface – System initialization: reasons for notification chains, system initialization overview, device registration and initialization, goals of NIC initialization, interaction between devices and kernel, examples of virtual devices, boot time kernel options, when a device is registered and unregistered – Transmission and reception: decisions and traffic direction, notifying drivers, interrupt handlers, reasons for bottom half handlers, bottom halves solutions, concurrency and locking, preemption, overview of network stack – Bridging: concepts, spanning tree protocol – Implementation aspects of networking.

UNIT V INTERNETWORKING 9

IPv4 concepts – Neighbouring subsystem concepts – Routing concepts, advanced features – Implementation aspects of internetworking.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Identify the different features of open source kernels
- Install and use available open source kernel
- Modify existing open source kernels in terms of functionality or features used
- Identify different features of open source networking
- Modify and use existing open source networking modules

REFERENCES:

1. Daniel P Bovet and Marco Cesati, "Understanding the Linux kernel", 3rd edition, O'Reilly, 2005.
2. Christian Benvenuti, "Understanding Linux Network Internals", O'Reilly, 2006.
3. Y-D Lin, R-H Hwang and Fred Baker, "Computer networks – an open source approach", McGraw-Hill, 2012.
4. Alessandro Rubini and Jonathan Corbet, "Linux device drivers", 2nd edition, O'Reilly, 2001.
5. Maurice J Bach, "The design of the Unix operating system", Pearson, 1986.

MA8154 ADVANCED MATHEMATICS FOR COMPUTING L T P C
3 1 0 4

OBJECTIVES:

- To understand the basics of random variables and standard distributions
- To understand the arrival process and various queueing and server models
- To appreciate the use of simulation techniques
- To apply testing of hypothesis to infer outcome of experiments
- To apply mathematical linear programming techniques to solve constrained problems.

UNIT I RANDOM VARIABLES 12

Random variables – Bernoulli, Binomial, Geometric, Poisson, Uniform, Exponential, Erlang and Normal distributions – Function of a Random variable - Moments, Moment generating function.

UNIT II QUEUING MODELS 12

Poisson Process – Markovian Queues – Single and Multi-server Models – Little's formula – Machine Interference Model – Steady State analysis – Self Service Queue.

UNIT III SIMULATION 12

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

UNIT IV TESTING OF HYPOTHESIS 12

Sampling distributions – Estimation of parameters - Statistical hypothesis – Tests based on Normal, t, Chi-square and F distributions for mean, variance and proportion.

UNIT V LINEAR PROGRAMMING 12

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

TOTAL :60 PERIODS

OUTCOMES:

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

- Identify the type of random variable and distribution for a given operational conditions/scene
- Study and Design appropriate queuing model for a given problem/system situation
- To understand and simulate appropriate application/distribution problems
- Differentiate/infer the merit of sampling tests.
- Formulate and find optimal solution in the real life optimizing/allocation/assignment problems involving conditions and resource constraints.

REFERENCES:

1. Johnson, R.A. Miller and Freund's," Probability and Statistical for Engineers, Prentice Hall of India Pvt., Ltd., New Delhi, Seventh Edition, 2005.
2. Hamdy A. Taha, "Operations Research: An Introduction", Prentice Hall of India Pvt., Ltd. New Delhi, Eighth Edition, 2007.
3. Jay L. Devore," Probability and Statistics for Engineering and the Sciences", Cengage Learning, Seventh Edition, 2009.
4. Ross. S.M., "Probability Models for Computer Science", Academic Press, 2002.
5. Winston, W.L., "Operations Research", Thomson – Brooks/Cole, Fourth Edition, 2003.
6. Gross D. and Harris C.M., "Fundamentals of Queuing Theory", John Wiley and Sons, New York, 1998.
7. J.Medhi," Stochastic models of Queuing Theory", Academic Press, Elsevier, Amsterdam, 2003

CP8111 **PROFESSIONAL PRACTICE** **L T P C**
0 0 2 1

THE OBJECTIVES OF PROFESSIONAL PRACTICE:
To Facilitate Research, Analysis, and Problem Solving.
To Interview people who know the context of the Problem and the Solution
To Explore various possible alternative solutions
To Estimate Risk

THE OUTCOMES OF PROFESSIONAL PRACTICE:
Formulating a Problem
Describing the Background of the Problem
Assessing the needs of the People
Framing a Policy
Predicting Business Opportunity
Understanding System Implications

TOTAL: 30 PERIODS

CP8201 **ADVANCES IN COMPILER DESIGN** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the various optimization techniques
- To understand about compiler's instruction selection and scheduling techniques
- To explore how parallelism is handled by compilers
- To understand how compilers deal with pipelining architecture
- To appreciate the just-in-time compilations

UNIT I COMPILER PHASE **9**
Compiler phases - Compiler techniques review - lexical & syntax analysis, intermediate representation (AST), etc. Introduction to compiler analysis & optimization – basic blocks – DAG – control flow analysis - Data flow analysis – Dependency analysis – dependency graphs – alias analysis

UNIT II OPTIMIZATION TECHNIQUES **9**
Optimization Techniques – Early optimization – redundancy elimination – loop optimization – Procedure optimization – Procedural analysis

UNIT III REGISTER ALLOCATION **9**
Register allocation strategies – issues – local register allocation and assignment – moving beyond single blocks – global register allocation – instruction selection – simple tree walk scheme – Pattern matching – peephole optimization – instruction scheduling – list scheduling

UNIT IV INSTRUCTION LEVEL PARALLELISM PROCESSOR ARCHITECTURES **9**
Instruction level parallelism Processor Architectures – code scheduling constraints – basic block scheduling – global code scheduling – software pipelining – optimization for parallelism - Basic concepts and examples – Iteration spaces – Affine array indexes – Data reuse – Array data dependence - Finding synchronization free parallelism – Synchronization between parallel loops,- Pipelining - Locality optimizations.

UNIT V INTERPROCEDURAL ANALYSIS BASIC CONCEPTS 9

Interprocedural analysis Basic concepts – need for inter-procedural analysis – logic representation of data flow – pointer-analysis algorithm – context insensitive and sensitive inter-procedural analysis - binary decision diagrams – Case study – HOT Compilation – Just-in-time compilation.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Identify the different optimization techniques that are possible for a sequence of code
- Design Compilers for a programming language
- Map the process of Compilation for a programming paradigm and design compiler for the same
- Design a system that uses just-in time compilation or HOT compilation

REFERENCES:

1. Aho, Lam, Sethi, & Ullman, **Compilers: Principles, Techniques, & Tools (Second Edition)**, Addison-Wesley, 2007. – Unit 1, 4, 5
2. Steven Muchnick, **Advanced Compiler Design and Implementation,** Morgan Kaufman Publishers, 1997 – Unit 2
3. Andrew W. Appel and Jens Palsberg, **Compiler Implementation in Java (2nd Ed.),** Cambridge University Press, 2002
4. Keith D. Cooper, Linda Torczon, **Engineering a Compiler,** Morgan Kaufman Publishers, 2003 – Unit 3
5. Randy Allen and Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence-based Approach", Morgan Kaufman, 2001.

CP8202 MACHINE LEARNING TECHNIQUES L T P C
3 0 2 4

OBJECTIVES:

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

UNIT I INTRODUCTION 9+6

Machine Learning - Machine Learning Foundations –Overview – applications - Types of machine learning - basic concepts in machine learning Examples of Machine Learning -Applications - Linear Models for Regression - Linear Basis Function Models - The Bias-Variance Decomposition - Bayesian Linear Regression - Bayesian Model Comparison

UNIT II SUPERVISED LEARNING 9+6

Linear Models for Classification - Discriminant Functions -Probabilistic Generative Models - Probabilistic Discriminative Models - Bayesian Logistic Regression. Decision Trees - Classification Trees- Regression Trees - Pruning. Neural Networks -Feed-forward Network Functions - Error Back-propagation - Regularization - Mixture Density and Bayesian Neural Networks - Kernel Methods - Dual Representations - Radial Basis Function Networks. Ensemble methods- Bagging- Boosting.

UNIT III UNSUPERVISED LEARNING 9+6

Clustering- K-means - EM - Mixtures of Gaussians - The EM Algorithm in General -Model selection for latent variable models - high-dimensional spaces -- The Curse of Dimensionality -Dimensionality Reduction - Factor analysis - Principal Component Analysis - Probabilistic PCA- Independent components analysis

UNIT IV PROBABILISTIC GRAPHICAL MODELS 9+6

Directed Graphical Models - Bayesian Networks - Exploiting Independence Properties - From Distributions to Graphs -Examples -Markov Random Fields - Inference in Graphical Models - Learning –Naive Bayes classifiers-Markov Models – Hidden Markov Models – Inference – Learning-Generalization – Undirected graphical models- Markov random fields- Conditional independence properties - Parameterization of MRFs - Examples - Learning - Conditional random fields (CRFs) - Structural SVMs

UNIT V ADVANCED LEARNING 9+6

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

TOTAL: 45 + 30 = 75 PERIODS

OUTCOMES:

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

- To implement a neural network for an application of your choice using an available tool
- To implement probabilistic discriminative and generative algorithms for an application of your choice and analyze the results
- To use a tool to implement typical clustering algorithms for different types of applications
- To design and implement an HMM for a sequence model type of application
- To identify applications suitable for different types of machine learning with suitable justification

REFERENCES:

1. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2006
2. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012
3. Ethem Alpaydin, “Introduction to Machine Learning”, Prentice Hall of India, 2005
4. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.
5. Hastie, Tibshirani, Friedman, “The Elements of Statistical Learning” (2nd ed)., Springer, 2008
6. Stephen Marsland, “Machine Learning –An Algorithmic Perspective”, CRC Press, 2009

CP8251 VIRTUALIZATION TECHNIQUES L T P C
3 0 2 4

OBJECTIVES:

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

UNIT I OVERVIEW OF VIRTUALIZATION 9+6

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

UNIT II SERVER AND NETWORK VIRTUALIZATION 9+6

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

UNIT III STORAGE, DESKTOP AND APPLICATION VIRTUALIZATION 9+6

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

UNIT IV APPLYING VIRTUALIZATION 9+6

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

UNIT V CLOUD COMPUTING 9+6

Cloud Computing Basics - Cloud Computing Definition – Evolution of Clod Computing - General Cloud Environments – Cloud Services – Service Providers – Google – Amazon – Microsoft – IBM – EMC – NetApp – Sales force – Tools for building private cloud - Open Issues in Cloud Computing – Cloud security challenges, **Cloud Programming:** Hadoop – Map Reduce – HDFS – Hadoop I/O – Developing a MapReduce Application

TOTAL: 45 + 30 = 75 PERIODS

OUTCOMES:

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

- Deploy legacy OSs on virtual machines
- Understand the intricacies of server, storage, network, desktop and application virtualizations
- Design new models for virtualization
- Design and develop cloud applications on virtual machine platforms
- Design new models for Bigdata processing in cloud

REFERENCES:

1. James E. Smith, Ravi Nair, - Virtual Machines: Versatile Platforms for Systems and Processes, Elsevier/Morgan Kaufmann, 2005.
2. David Marshall, Wade A. Reynolds, - Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach Publications, 2006.
3. Kumar Reddy, Victor Moreno, - Network virtualization, Cisco Press, July, 2006.
4. Chris Wolf, Erick M. Halter, - Virtualization: From the Desktop to the Enterprise, APress 2005.
5. Danielle Ruest, Nelson Ruest - Virtualization: A Beginner's Guide, TMH, 2009

6. Kenneth Hess , Amy Newman: Practical Virtualization Solutions: Virtualization from the Trenches Prentice Hall 2010
7. John Rittinghouse, James Ransome, Cloud Computing, Implementation, Management and Strategy, CRC Press, 2010
8. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter - Cloud Computing: A Practical Approach, TMH, 2010
9. Lee Badger , Tim Grance , Robert Patt-Corner , Jeff Voas - Cloud Computing Synopsis and Recommendations NIST, May 2011
10. Tom White - Hadoop: The Definitive Guide Storage and Analysis at Internet Scale O'Reilly Media Press May 2012
11. Dave Shackleford - Virtualization security- Protecting Virtualized Environments, Sybex Publishers, First Edition, 2012

IF8254 MOBILE AND PERVASIVE COMPUTING L T P C
3 0 0 3

OBJECTIVES :

- To understand the basics of Mobile computing and Personal computing.
- To learn the role of wireless networks in Mobile Computing and Pervasive Computing.
- To study about the underlying wireless networks.
- To understand the architectures of mobile and pervasive applications.
- To become familiar with the pervasive devices and mobile computing platforms.

UNIT I INTRODUCTION 9

Differences between Mobile Communication and Mobile Computing – Contexts and Names – Functions – Applications and Services – New Applications – Making Legacy Applications Mobile Enabled – Design Considerations – Integration of Wireless and Wired Networks – Standards Bodies – Pervasive Computing – Basics and Vision – Principles of Pervasive Computing – Categories of Pervasive Devices

UNIT II 3G AND 4G CELLULAR NETWORKS 9

Migration to 3G Networks – IMT 2000 and UMTS – UMTS Architecture – User Equipment – Radio Network Subsystem – UTRAN – Node B – RNC functions – USIM – Protocol Stack – CS and PS Domains – IMS Architecture – Handover – 3.5G and 3.9G a brief discussion – 4G LAN and Cellular Networks – LTE – Control Plane – NAS and RRC – User Plane – PDCP, RLC and MAC – WiMax IEEE 802.16d/e – WiMax Internetworking with 3GPP

UNIT III SENSOR AND MESH NETWORKS 9

Sensor Networks – Role in Pervasive Computing – In Network Processing and Data Dissemination – Sensor Databases – Data Management in Wireless Mobile Environments – Wireless Mesh Networks – Architecture – Mesh Routers – Mesh Clients – Routing – Cross Layer Approach – Security Aspects of Various Layers in WMN – Applications of Sensor and Mesh networks

UNIT IV CONTEXT AWARE COMPUTING 9

Adaptability – Mechanisms for Adaptation - Functionality and Data – Transcoding – Location Aware Computing – Location Representation – Localization Techniques – Triangulation and Scene Analysis – Delaunay Triangulation and Voronoi graphs – Types of Context – Role of Mobile Middleware – Adaptation and Agents – Service Discovery Middleware

UNIT V APPLICATION DEVELOPMENT 9

Three tier architecture - Model View Controller Architecture - Memory Management – Information Access Devices – PDAs and Smart Phones – Smart Cards and Embedded Controls – J2ME – Programming for CLDC – GUI in MIDP – Application Development ON Android and iPhone.

TOTAL: 45 PERIODS

OUTCOMES:

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

- To deploy 3G networks.
- To develop suitable algorithms for 4G networks.
- To use sensor and mesh networks to develop mobile computing environment.
- To develop mobile computing applications based on the paradigm of context aware computing.

REFERENCES:

1. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, “Mobile Computing: Technology, Applications and Service Creation”, Second Edition, Tata McGraw Hill, 2010.
2. Reto Meier, “Professional Android 2 Application Development”, Wrox Wiley, 2010.
3. .Pei Zheng and Lionel M Li, ‘Smart Phone & Next Generation Mobile Computing’, Morgan Kaufmann Publishers, 2006.
4. Frank Adelstein, ‘Fundamentals of Mobile and Pervasive Computing’, TMH, 2005
5. Jochen Burthardt et al, ‘Pervasive Computing: Technology and Architecture of Mobile Internet Applications’, Pearson Education, 2003
6. Feng Zhao and Leonidas Guibas, ‘Wireless Sensor Networks’, Morgan Kaufmann Publishers, 2004
7. Uwe Hansmaan et al, ‘Principles of Mobile Computing’, Springer, 2003
8. Reto Meier, “Professional Android 2 Application Development”, Wrox Wiley, 2010.
9. Stefan Poslad, “Ubiquitous Computing: Smart Devices, Environments and Interactions”, Wiley, 2009.

CP8211 CASE STUDY L T P C

0 0 2 1

The case study approach is to engage students in critical thinking for real world situations. As Students, they turn basic knowledge into principles that can be applied across cases. By placing them in real situations, and requiring them to make decisions, students learn to connect their knowledge with analytical skills.

A Case Study includes Research, Analysis, and Problem Solving.
Interviewing people who know the place or the situation is a vital step.
There is no single solution. A case study includes.

Introduction
Background
People
Policy
Business Opportunity
System Implications

TOTAL: 30 PERIODS

CP8212 **TECHNICAL SEMINAR** **L T P C**
0 0 2 1

THE OBJECTIVES OF TECHNICAL SEMINAR ARE:

1. To elicit pro-active participation of the students through
2. To entrust assignment to present
3. To inculcate presentation and leadership skills among students
4. To involving students to learn actively
5. To offer opportunities of interaction with peer students and staff.

THE OUTCOMES OF THE TECHNICAL SEMINAR ARE:

1. Good Communications Skills.
2. Knowing the Audience.
3. Choosing the Topic.
4. Setting the Goals for the Talk.
5. Talking to the Audience.
6. Knowing the Content of the Talk.
7. Preparation of the Slides.
8. Answering Questions.
9. Managing Time.

TOTAL: 30 PERIODS

CP8351 **SECURITY PRINCIPLES AND PRACTICES** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the mathematical foundations of security principles
- To appreciate the different aspects of encryption techniques
- To understand the role played by authentication in security
- To appreciate the current trends security practices

UNIT I INTRODUCTION AND MATHEMATICAL FOUNDATION 9

An illustrative communication game – safeguard versus attack – Probability and Information Theory - Algebraic foundations – Number theory.

UNIT II ENCRYPTION – SYMMETRIC TECHNIQUES 9

Substitution Ciphers – Transposition Ciphers – Classical Ciphers – DES – AES – Confidentiality Modes of Operation – Key Channel Establishment for symmetric cryptosystems.

UNIT III ENCRYPTION – ASYMMETRIC TECHNIQUES AND DATA TECHNIQUES 9

Diffie-Hellman Key Exchange protocol – Discrete logarithm problem – RSA cryptosystems & cryptanalysis – ElGamal cryptosystem – Need for stronger Security Notions for Public key Cryptosystems – Combination of Asymmetric and Symmetric Cryptography – Key Channel Establishment for Public key Cryptosystems - Data Integrity techniques – Symmetric techniques - Asymmetric techniques

UNIT IV AUTHENTICATION 9

Authentication Protocols Principles – Authentication protocols for Internet Security – SSH Remote logic protocol – Kerberos Protocol – SSL & TLS – Authentication frame for public key Cryptography – Directory Based Authentication framework – Non - Directory Based Public-Key Authentication framework .

UNIT V SECURITY PRACTICES 9

Protecting Programs and Data – Information and the Law – Rights of Employees and Employers – Software Failures – Computer Crime – Privacy – Ethical Issues in Computer Security.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Use the mathematical foundations in security principles
- Identify the features of encryption and authentication
- Use available security practices

REFERENCES:

1. William Stallings, "Crpyptography and Network security: Principles and Practices", Pearson/PHI, 5th Edition, 2010.
2. Behrouz A. Forouzan, "Cryptography and Network Security", 2nd Edition, Tata McGraw Hill Education, 2010.
3. Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with coding theory", 2nd Edition, Pearson, 2007.
4. Douglas R. Stinson ,"Cryptography Theory and Practice ", 3rd Edition, Chapman & Hall/CRC, 2006.
5. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education, 2nd Edition, 2007.
6. Charles P. Pfleeger, Shari Lawrence Pfleeger, "Security in computing", 3rd Edition, Prentice Hall of India, 2006.
7. Wenbo Mao, "Modern Cryptography – Theory and Practice", Pearson Education, 2006.
8. Charlie Kaufman, Radia Perlman and Mike Speciner, " Network Security Private Communication in a Public World", PHI, Second Edition, 2012

CP8001 ADVANCED COMPUTING L T P C
3 0 0 3

OBJECTIVES:

- To understand the basics of quantum computing, membrane computing, molecular computing, DNA computing and nano computing
- To understand the models and the theory involved in the biologically inspired computing techniques
- To explore the applications of these computing models

UNIT I INTRODUCTION 9

Strings – notations – Regular languages – Context free languages – Context free Grammar – Context Sensitive Grammar – Type 0 Grammar – Universal Turing machine – Lindenmayer systems – Enumerable languages – Complexity

UNIT II DNA COMPUTING 9

Structure of DNA – Operation on DNA molecules – Adleman's experiments – Other DNA solutions to NP problems – Two dimensional generalization – Computing by carving – Sticker systems – Extended H systems – Controlled H systems – distributed H systems

UNIT III MEMBRANE COMPUTING 9

P systems with labelled membranes – examples – Power of P systems – decidability results – Rewriting P systems – P systems with polarized membranes – Normal forms – P systems on Asymmetric graphs – P systems with active membranes – Splicing P systems – Variants, Problems, Conjectures.

UNIT IV QUANTUM COMPUTING 9

Reversible computation – Copy computers – Quantum world – Bits and Qubits – Quantum calculus – Qubit evolution – Measurements – Zeno machines – Randomness – EPR conundrum and Bell's theorem – Quantum logic – Quantum computers – Quantum algorithms – Quantum Complexity – Quantum Cryptography

UNIT V NANO AND MOLECULAR COMPUTING 9

Defect tolerant nano computing – error detection – Non-traditional computing models – Reliability trade off for nano architecture – Molecular recognition – storage and processing of molecular information

TOTAL:45 PERIODS

OUTCOMES:

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

- Comprehend the different computing paradigms
- Write Grammar rules for the different models of computing
- Design applications to incorporate one or more computing models
- Try to solve problems and prove the application of the computing models.

REFERENCES:

1. Cris Calude Gheorghe Paun, " Computing with Cells and Atoms: An Introduction to Quantum, DNA and Membrane Computing", CRC Press, 2000. Unit 1 – 4
2. Sandeep Kumar Shukla, R Iris Bahar, " Nano, Quantum and Molecular Computing: Implications to High Level Design and Validation",Kluwer Academic Publishers, 2010. Unit 5
3. Tanya Sienko, Andrew Adamatzky, Michael Conrad , Nicholas G. Rambidi, "Molecular Computing", MIT Press, 2005. Unit 5
4. Kamala Krithivasan and Rama R, "Introduction to Formal languages, automata theory and computation", Pearson Education India, 2009.

CP8002 COMPUTATIONAL GAME THEORY L T P C

3 0 0 3

OBJECTIVES:

- To introduce the student to the notion of a game, its solutions concepts, and other basic notions and tools of game theory, and the main applications for which they are appropriate, including electronic trading markets;
- To formalize the notion of strategic thinking and rational choice by using the tools of game theory, and to provide insights into using game theory in modeling applications;
- To draw the connections between game theory, computer science, and economics, especially emphasizing the computational issues;
- To introduce contemporary topics in the intersection of game theory, computer science, and economics;

UNIT I INTRODUCTION 8

Introduction – Making rational choices: basics of Games – strategy - preferences – payoffs – Mathematical basics -Game theory –Rational Choice - Basic solution concepts-non-cooperative versus cooperative games - Basic computational issues - finding equilibria and learning in games- Typical application areas for game theory (e.g. Google's sponsored search, eBay auctions, electricity trading markets).

UNIT II GAMES WITH PERFECT INFORMATION 10

Games with Perfect Information - Strategic games - prisoner's dilemma, matching pennies- Nash equilibria- theory and illustrations - Cournot's and Bertrand's models of oligopoly- auctions- mixed strategy equilibrium- zero-sum games- Extensive Games with Perfect Information-repeated games (prisoner's dilemma)- subgame perfect Nash equilibrium; computational issues.

UNIT III GAMES WITH IMPERFECT INFORMATION 9

Games with Imperfect Information - Bayesian Games – Motivational Examples – General Definitions –Information aspects – Illustrations - Extensive Games with Imperfect -Information - Strategies- Nash Equilibrium – Beliefs and sequential equilibrium – Illustrations - Repeated Games - The Prisoner's Dilemma - Bargaining

UNIT IV NON-COOPERATIVE GAME THEORY 9

Non-cooperative Game Theory - Self-interested agents- Games in normal form - Analyzing games: from optimality to equilibrium - Computing Solution Concepts of Normal-Form Games - Computing Nash equilibria of two-player, zero-sum games -Computing Nash equilibria of two-player, general-sum games - Identifying dominated strategies

UNIT V MECHANISM DESIGN 9

Aggregating Preferences-Social Choice – Formal Model- Voting - Existence of social functions - Ranking systems - Protocols for Strategic Agents: Mechanism Design - Mechanism design with unrestricted preferences- Efficient mechanisms - Vickrey and VCG mechanisms (shortest paths) - Combinatorial auctions - profit maximization Computational applications of mechanism design - applications in Computer Science - Google's sponsored search - eBay auctions

TOTAL: 45 PERIODS

OUTCOMES:

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

- Discuss the notion of a strategic game and equilibria, and identify the characteristics of main applications of these concepts
- Do a literature survey on applications of Game Theory in Computer Science and Engineering
- Discuss the use of Nash Equilibrium for other problems
- Identify key strategic aspects and based on these be able to connect them to appropriate game theoretic concepts given a real world situation
- Identify some applications that need aspects of Bayesian Games
- Implement a typical Virtual Business scenario using Game theory

REFERENCES:

1. M. J. Osborne, An Introduction to Game Theory. Oxford University Press, 2004.
2. N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani (Editors), Algorithmic Game Theory. Cambridge University Press, 2007.
3. M. J. Osborne and A. Rubinstein, A Course in Game Theory. MIT Press, 1994.
4. A.Dixit and S. Skeath, Games of Strategy, Second Edition. W W Norton & Co Inc, 2004.
5. Yoav Shoham, Kevin Leyton-Brown, Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, Cambridge University Press 2008
6. Zhu Han, Dusit Niyato,Walid Saad,Tamer Basar and Are Hjorungnes, “Game Theory in Wireless and Communication Networks”, Cambridge University Press, 2012

CP8003 **COMPUTATIONAL GEOMETRY** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand geometric problems.
- To learn the algorithmic solutions for geometric problems.
- To map problems in various application domains to a geometric problem.
- To learn to solve problems in various application domains

UNIT I INTRODUCTION **9**

Introduction –Application Domains – Line Segment Intersection – Intersection of Convex Polygons – Polygon Triangulation

UNIT II GEOMETRIC SEARCHING **9**

Geometric Searching – Range Searching – Kd-Trees – Range trees – Point-Location Problems

UNIT III CONVEX HULL PROBLEM **9**

Convex hull Problem – Preliminaries – Convex hull Algorithms in the Plane – Graham's scan - Jarvis's March – Quick Hull – Divide-and-conquer – Dynamic Convex Hull Maintenance – Delaunay Triangulation

UNIT IV PROXIMITY PROBLEMS **9**

Proximity Problems – Fundamental Algorithms (Closest Pair – All Nearest Neighbours – Euclidean Minimum Spanning Tree – Nearest Neighbour Search) – Lower bounds – Closest Pair Problem : A Divide-and-Conquer Approach

UNIT V VORONOI DIAGRAM **9**

Voronoi Diagram – Proximity Problems Solved by the Voronoi Diagram – Planar Applications

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course the students will be able to

- Identify problems that can be mapped to geometric problems
- Transform problems in different applications to geometric problems
- Use the algorithms learnt for solving the transformed problems
- Find solution for the problems

REFERENCES:

1. Franco P. Preparata, Michael I. Shamos, Computational Geometry: An Introduction, Springer, 1985.
2. Mark de Berg, Otfried Cheong, Marc van Kreveld, Mark Overmars, Computational Geometry: Algorithms and Applications, Springer, 3rd edition, 2008.
3. Satyan L. Devadoss and Joseph O'Rourke, Discrete and Computational Geometry, Princeton University Press, 2011.
4. Herbert Edelsbrunner, Algorithms in Combinatorial Geometry, EATCS Monographs in Computer Science, SpringerVerlag, 1987

CP8004 **PARALLEL ALGORITHMS** **L T P C**
3 0 0 3

OBJECTIVES:

- To learn parallel algorithms development techniques for shared memory and DCM models.
- To study the main classes of fundamental parallel algorithms.
- To study the complexity and correctness models for parallel algorithms

UNIT I INTRODUCTION **9**

Introduction to Parallel Algorithms – Models of computation – Selection – Mergin on EREW and CREW – Median of two sorted sequence – Fast Merging on EREW – Analyzing Parallel Algorithms.

UNIT II SORTING & SEARCHING **9**

Sorting Networks – Sorting on a Linear Array – Sorting on CRCW, CREW, EREW – Searching a sorted sequence – Searching a random sequence – Bitonic Sort.

UNIT III ALGEBRAIC PROBLEMS **9**

Permutations and Combinations – Matrix Transpositions – Matrix by Matrix multiplications – Matrix by vector multiplication.

UNIT IV GRAPH & GEOMETRY **9**

Connectivity Matrix – Connected Components – All Pair Shortest Paths – Minimum Spanning Trees – Point Inclusion – Intersection, Proximity and Construction Problems.

UNIT V OPTIMIZATION & BIT COMPUTATIONS **9**

Prefix Sums – Job Sequencing – Knapsack - Adding two integers – Adding n integers – Multiplying two integers – Selection.

TOTAL: 45 PERIODS

OUTCOMES:

- Familiar with design of parallel algorithms in various models of parallel computation.
- Familiar with the efficient parallel algorithms related to many areas of computer science: expression computation, sorting, graph-theoretic problems, computational geometry, etc.
- Familiar with the basic issues of implementing parallel algorithms.

REFERENCES:

1. Selim G. Akl, The Design and Analysis of Paralle Algorithms, Prentice Hall, New Jercy, 1989.
2. Michael J. Quinn, Parallel Computing : Theory & Practice, Tata McGraw Hill Edition, 2003.
3. Joseph JaJa, Introduction to Parallel Algorithms, Addison-Wesley, 1992.

CP8005 **PARALLEL SYSTEMS** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the concepts of parallel computing and parallel systems' architecture
- To understand the two popular parallel programming paradigms (message passing and shared memory)
- To understand major performance issues for parallel systems and programs;
- To reiterate hot topics in research on parallel computing;

UNIT I ARCHITECTURES **5**

The changing role of parallelism - Basic Principles - Sources of inefficiency - Metrics: Execution time, speedup, etc. – Throughput vs. latency – Scalability: massive parallelism, Amdahl's Law, Gustafson's Law - Parallel architectures – Trends in architectures, CMPs, GPUs, and Grids, Multiprocessors, Multicomputers, Multithreading, Pipelining, VLIWs, Superscaling, Vectors, SIMDs, paradigm of shared-memory, distributed-memory, interconnection networks, optical computing, systolic arrays, cache coherence -– Models of parallelism: PRAM, CTA

UNIT II PROGRAMMING MODELS **5**

Parallel Programming: Low Level Approaches – Threads – Message passing – Issues in scalability and portability – Transactional Memory - Parallel Programming: Higher Level Approaches – ZPL – Automatic Parallelization and HPF – Chapel – Map Reduce

UNIT III OPTIMIZATION **15**

Principles Of Compiler – Compiler Structure – Properties of a Compiler – Optimization –Importance of Code optimization – Structure of Optimizing compilers – placement ofoptimizations in optimizing compilers – ICAN – Introduction and Overview – Symboltable structure – Local and Global Symbol table management - Intermediate representation – Issues – High level, medium level, low level intermediate languages – MIR, HIR, LIR – ICAN for Intermediate code – Optimization – Early optimization – Constant folding – scalar replacement of aggregates – Simplification – value numbering – constant propagation – redundancy elimination – loop optimization

UNIT IV LOOP PARALLELIZATIONS **12**

Loop transformations, loop parallelizations, Data-Parallel and Data-Flow Systems Connection MachineCM5 - Data-Flow Models -Parallel Programming Concept dependence and loop parallelization - parallelism profiling Data-Path Design Parallel and Pipelined Design - Scheduling Parallel Programs-Optimal Scheduling Algorithms - Scheduling Heuristics -Loop Transformation and Scheduling -Parallelizing Serial Programs -Data Dependency Test -Parallelization Techniques - Instruction-Level Parallelism

UNIT V SCHEDULING **8**

Task partitioning - data sharing and task distribution/scheduling - static, dynamic, and speculative tasks - shared memory, message passing, check-in/check-out -collaborative real-time editing-version control systems -synchronization and communication **fundamentals** -synchronous, asynchronous scheduling -semantics -data sharing: race, dependence, the Bernstein condition -progress: lock and wait freedom - message passing: put/get, send/recv, collectives, Service Support, Resource Management, Availability, Reliability, Security, Fault Tolerance, Recovery, Protection, Scaling.

TOTAL : 45 PERIODS

OUTCOMES:

- To understand the concepts of parallel computing and parallel systems' architecture
- To understand the two popular parallel programming paradigms (message passing and shared memory)
- To understand major performance issues for parallel systems and programs;
- To reiterate hot topics in research on parallel computing;

REFERENCES:

1. David Culler and Jaswinder Pal Singh, Parallel Computer Architecture, Morgan Kaufmann, 1999, ISBN 1-55860-343-3.
2. Wilkinson B. & Allen M., Parallel Programming: Techniques & Applications Using Networked Workstations, Prentice Hall (2nd Ed), 2005, ISBN: 0131918656
3. T. G. Lewis and H. El-Rewini, Introduction to Parallel Computing,Prentice-Hall, Englewood Cliffs, NJ, 1992.
4. K. Mani and S. Tayler, An Introduction to Parallel Programming Jones and Barlett Publishers, 1992.
5. Ian Foster, Designing and Building Parallel Programs, Addison-Wesley, 1994.
   Michael Wolfe, High Performance Compilers for Parallel Computing, Addison-Wesley, 1996, ISBN 0-8053-2730-4.
6. U. Banerjee, Loop Parallelization, Kluwer, 1994.
7. Steven S. Muchnick, "Advanced Compiler Design Implementation", Morgan Koffman – Elsevier Science, India, Indian Reprint 2003.

CP8006 FAULT TOLERANT SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

- To provide a comprehensive view of fault tolerant systems
- To appreciate the need for fault tolerance
- To expose the students to the methods of hardware fault tolerance
- To understand the different ways of providing information redundancy
- To understand the need for and the different ways of providing software fault tolerance
- To expose the students to concept of check pointing and their role in providing fault tolerance
- To understand how to handle security attacks

UNIT I INTRODUCTION: 9

Fault Classification, Types of Redundancy, Basic Measures of Fault Tolerance, Hardware Fault Tolerance, The Rate of Hardware Failures, Failure Rate, Reliability, and Mean Time to Failure, Canonical and Resilient Structures, Other Reliability Evaluation Techniques, Processor level Techniques.

UNIT II INFORMATION REDUNDANCY 9

Information Redundancy, Coding, Resilient Disk Systems, Data Replication, Voting: Hierarchical Organization, Primary-Backup Approach, Algorithm-Based Fault Tolerance, Fault-Tolerant Networks: Measures of Resilience, Common Network Topologies and Their Resilience, Fault- Tolerant Routing.

UNIT III SOFTWARE FAULT TOLERANCE: 9

Acceptance Tests, Single-Version Fault Tolerance, N-Version Programming, Recovery Block Approach, Preconditions, Post conditions, and Assertions, Exception-Handling, Software Reliability Models, Fault-Tolerant Remote Procedure Calls.

UNIT IV CHECKPOINTING: 9

Introduction, Checkpoint Level, Optimal Checkpointing-An Analytical Model, Cache-Aided Rollback Error Recovery (CARER), Checkpointing in Distributed Systems, Checkpointing in Shared-Memory

Systems, Checkpointing in Real-Time Systems, Case Studies: NonStop Systems, Stratus Systems, Cassini Command and Data Subsystem, IBM G5, IBM Sysplex, Itanium

UNIT V FAULT DETECTION IN CRYPTOGRAPHIC SYSTEMS 9

Security Attacks Through Fault Injection – Fault Attacks on Symmetric Key Ciphers – Fault Attacks on Public (Asymmetric) Key Ciphers – Counter Measures – Spatial and Temporal Duplication – Error Detecting Codes.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Define the traditional measures of fault tolerance
- Discuss the various hardware fault tolerance techniques used
- Point out the processor level fault tolerance techniques
- Discuss error detecting and correcting codes
- Critically analyze the different types of RAID levels
- Discuss the different network topologies and their resilience
- Discuss techniques like recovery blocks and N-version programming
- Define check pointing and models for optimal check pointing
- Identify techniques for check pointing in distributed and shared memory systems
- Distinguish between symmetric key ciphers and public key ciphers
- Provide techniques to detect injected faults in ciphers

REFERENCES:

1. Israel Koren, Mani Krishna, “Fault Tolerant Systems”, Elsevier Science & Technology, 2007.
2. Parag K. Lala “Fault Tolerant and Fault Testable Hardware Design”, Prentice-Hall International, 1985.
3. LL Pullam, “Software Fault Tolerance Techniques and Implementation”, Artech House Computer Security Series, 2001.
4. Martin L Shooman, Willey, “Reliability of Computer Systems and Networks: Fault Tolerance, Analysis and Design”, 2002.

CP8007 NETWORK PROTOCOLS L T P C
3 0 0 3

OBJECTIVES:

- To understand how routing is done in telephone networks
- To learn about the different internet routing protocols
- To appreciate the different aspects routing in optical and mobile networks
- To understand the issues in ad hoc networks the protocols used for th working of ad hoc networks

UNIT I INTRODUCTION 8

ISO OSI Layer Architecture, TCP/IP Layer Architecture, Functions of Network layer, General Classification of routing, Routing in telephone networks, Dynamic Non hierarchical Routing (DNHR), Trunk status map routing (TSMR), real-time network routing (RTNR), Distance vector routing, Link state routing, Hierarchical routing.

UNIT II INTERNET ROUTING PROTOCOLS 9

Interior routing protocols: Routing Information Protocol (RIP), Open Shortest Path First (OSPF) – Exterior Routing Protocols: Exterior Gateway Protocol (EGP) and Border Gateway Protocol (BGP). Multicast Routing: Pros and cons of Multicast and Multiple Unicast Routing, Distance Vector Multicast Routing Protocol (DVMRP), Multicast Open Shortest Path First (MOSPF), MBONE, Core Based Tree Routing.

UNIT III ROUTING IN OPTICAL WDM NETWORKS 10

Classification of Routing and Wavelength Assignment algorithms – RWA algorithms, Fairness and Admission Control – Distributed Control Protocols – Permanent Routing and Wavelength Requirements – Wavelength Rerouting – Benefits and Issues – Lightpath Migration – Rerouting Schemes – Algorithms – AG – MWPG

UNIT IV MOBILE - IP NETWORKS 9

Macro-mobility Protocols - Micro-mobility protocols – Tunnel based – Hierarchical Mobile IP – Intra domain Mobility Management – Routing based – Cellular IP - Handoff – Wireless Access Internet Infrastructure (HAWAII)

UNIT V MOBILE AD HOC NETWORKS 9

Issues and challenges in ad hoc networks – MAC Layer Protocols for wireless ad hoc networks – Contention-Based MAC protocols – Routing in Ad hoc Networks – Design Issues – Proactive, Reactive and Hybrid Routing Protocols - Transport protocols for ad hoc networks.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Identify challenges in routing in different kinds of networks
- Identify the features of the protocols used in different kinds of networks
- Compare the issues in designing protocols for different kinds of networks

REFERENCES:

1. William Stallings, 'High-Speed Networks and Internets, Performance and Quality of Service', IInd Edition, Pearson Education Asia. Reprint India 2002
2. Martha Steenstrup, 'Routing in Communication Networks', Prentice Hall International, New York, 1995.
3. S. Keshav, 'An Engineering Approach to Computer Networking' Addison Wesley 1999.
4. William Stallings, 'High speed Networks TCP/IP and ATM Design Principles, Prentice- Hall, New York, 1998.
5. Deepankar Medhi, Karthikeyan Ramasamy, 'Network Routing: Algorithms, Protocols, and Architectures', Morgan Kaufmann Publishers, 2007.
6. Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, 'Ad Hoc Mobile Wireless Networks', Auerbach Publications, 2008.
7. C.Siva Ram Murthy and B.S.Manoj, 'Ad Hoc Wireless Networks – Architectures and Protocols', Pearson Education, 2004.
8. Ian F. Akyildiz, Jiang Xie and Shantidev Mohanty, 'A Survey of mobility Management in Next generation All IP- Based Wireless Systems', IEEE Wireless Communications Aug.2004, pp 16-27.
9. A.T Campbell et al., 'Comparison of IP Micromobility Protocols', IEEE Wireless Communications Feb.2002, pp 72-82.
10. C.Siva Rama Murthy and Mohan Gurusamy, "WDM Optical Networks – Concepts, Design and Algorithms", Prentice Hall of India Pvt. Ltd, New Delhi, 2002.

CP8074 REAL TIME SYSTEMS DESIGN L T P C
3 0 0 3

OBJECTIVE :

- To learn real time operating system concepts and the associated issues & techniques

UNIT I REAL TIME SPECIFICATION AND DESIGN TECHNIQUES 9

Introduction– Structure of a Real Time System –Task classes – Performance Measures for Real Time Systems – Estimating Program Run Times – Issues in Real Time Computing – Task Assignment and Scheduling – Classical uniprocessor scheduling algorithms –Fault Tolerant Scheduling.

UNIT II REAL TIME SPECIFICATION AND DESIGN TECHNIQUES 9

Natural languages – mathematical specification – flow charts – structured charts – pseudocode and programming design languages – finite state automata – data flow diagrams – petri nets – Warnier Orr notation – state charts – polled loop systems – phase / sate driven code – coroutines – interrupt – driven systems – foreground/background system – full featured real time operating systems.

UNIT III INTERTASK COMMUNICATION AND SYNCHRONIZATION 9

Buffering data – mailboxes – critical regions – semaphores – deadlock – process stack management – dynamic allocation – static schemes – response time calculation – interrupt latency – time loading and its measurement – scheduling is NP complete – reducing response times and time loading – analysis of memory requirements – reducing memory loading – I/O performance.

UNIT IV REAL TIME DATABASES 9

Real time Databases – Basic Definition, Real time Vs General Purpose Databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Two – phase Approach to improve Predictability – Maintaining Serialization Consistency – Databases for Hard Real Time Systems.

UNIT V EVALUATION TECHNIQUES 9

Reliability Evaluation Techniques – Obtaining parameter values, Reliability models for Hardware Redundancy – Software error models. Clock Synchronization – Clock, A Nonfault – Tolerant Synchronization Algorithm – Impact of faults – Fault Tolerant Synchronization in Hardware – Fault Tolerant Synchronization in software.

TOTAL : 45 PERIODS

OUTCOME:

- Understanding principles of real time systems design; be aware of architectures and behaviors of real time operating systems, database and applications.

REFERENCES:

1. C.M. Krishna, Kang G. Shin, “Real – Time Systems”, McGraw – Hill International Editions, 1997.
2. Rajib Mall, ”Real-time systems: theory and practice”, Pearson Education, 2007
3. Stuart Bennett, “Real Time Computer Control – An Introduction”, Prentice Hall of India, 1998.
4. R.J.A Buhur, D.L Bailey, “An Introduction to Real – Time Systems”, Prentice – Hall International, 1999.
5. Philip.A.Laplante, “Real Time System Design and Analysis”, Prentice Hall of India, 3rd Edition, April 2004.
6. Allen Burns, Andy Wellings, “Real Time Systems and Programming Languages”, Pearson Education, 2003.

IF8083 **UNIX INTERNALS** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the design of the UNIX operating system.
- To become familiar with the various data structures used.
- To learn the various low-level algorithms used in UNIX.

UNIT I OVERVIEW **9**

General Overview of the System: History – System structure – User perspective –Operating System Services – Assumptions about Hardware. Introduction to the Kernel Architecture of the UNIX Operating System – Introduction to System Concept - The Buffer Cache - Buffer headers – Structure of the Buffer Pool – Scenarios for Retrieval of a Buffer– Reading and Writing Disk Blocks – Advantages and Disadvantages of the Buffer Cache.

UNIT II FILE SUBSYSTEM **9**

Internal Representation of Files: Inodes – Structure of a Regular File – Directories –Conversion of a Path Name to an Inode – Super Block – Inode Assignment to a New File – Allocation of Disk Blocks.

UNIT III SYSTEM CALLS FOR THE FILE SYSTEM **9**

Open – Read – Write – File And Record Locking – Adjusting the Position of File I/O –lseek – close – File Creation – Creation of Special Files – Changing Directory – Root – Owner - Mode – stat And fstat – Pipes – dup – Mounting And Unmounting File Systems – link – unlink.

UNIT IV PROCESSES **9**

Process States and Transitions – Layout of System Memory – The Context of a Process – Saving the Context of a Process – Manipulation of the Process Address Space – Sleep - Process Control - Process Creation – Signals – Process Termination – Awaiting Process Termination – Invoking other Programs – User Id of a Process – Changing the size of a Process – Shell – System Boot and the INIT Process– Process Scheduling.

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

Memory Management Policies – Paging and Segmentation - Swapping – Demand Paging - The I/O Subsystem: Driver Interface – Disk Drivers – Terminal Drivers.

TOTAL: 45 PERIODS

OUTCOMES:

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

- To understand the design of the UNIX operating system.
- To become familiar with the various data structures used.
- To learn the various low-level algorithms used in UNIX.

REFERENCES:

1. Maurice J. Bach, “The Design of the Unix Operating System”, First Edition, Pearson Education, 1999.
2. B. Goodheart, J. Cox, “The Magic Garden Explained”, Prentice Hall of India,1986.
3. S. J. Leffler, M. K. Mckusick, M. J. .Karels and J. S. Quarterman., “The Design and Implementation of the 4.3 BSD Unix Operating System”, Addison Wesley, 1998.

CP8008 **BIO INFORMATICS** **L T P C**
3 0 0 3

OBJECTIVE:

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

UNIT I INTRODUCTORY CONCEPTS 8

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

UNIT II SEARCH ENGINES, VISUALIZATION AND ALGORITHMS 10

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

UNIT III STATISTICS AND DATA MINING 9

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

UNIT IV PATTERN MATCHING 9

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

UNIT V MODELING AND SIMULATION 9

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

TOTAL : 45 PERIODS

OUTCOMES:

- Will able to have basic idea of BioInformatics.
- Will able to retrieve information's using various algorithms and techniques.
- Will able to sequence the databases.
- Will able to do modeling and simulation.

REFERENCES:

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

CP8009 BIO-INSPIRED ARTIFICIAL INTELLIGENCE L T P C
3 0 0 3

OBJECTIVES:

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

UNIT I EVOLUTIONARY SYSTEMS 9

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

UNIT II NEURAL AND FUZZY SYSTEMS 9

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

UNIT III CELLULAR AND DEVELOPMENT SYSTEMS 9

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

UNIT IV IMMUNE SYSTEMS AND COLLECTIVE SYSTEMS 10

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

UNITV BEHAVIORAL SYSTEMS 8

Behavioral Systems **-** Behavior in Cognitive Science - Behavior in Artificial Intelligence - Behavioral Systems – Behavior Based Robots –Evolution - Co-evolution - Learning and Self Reproduction of Behavioral Systems. Cultural Algorithms **-** Culture and Artificial Culture - Cultural Algorithm - Belief Space – Fuzzy Cultural Algorithms – Applications. Co-evolution – Types - Competitive and Cooperative Co-evolution.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Use existing open source tools to build an application using genetic approaches
- Identify different applications suitable for different types of neural networks giving justifications
- Critically analyze the use of cellular systems
- Differentiate the different models of immune systems
- Do a literature survey on applications of artificial immune systems
- Implement the Particle swarm and Ant colony algorithms within a framework and build applications

REFERENCES:

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

CP8010 COGNITIVE SCIENCE L T P C
3 0 0 3

OBJECTIVES:

- To learn the basics of Cognitive Science with focus on acquisition, representation, and use of knowledge by individual minds, brains, and machines, as well as groups, institutions, and other social entities
- To study the mind and intelligence, embracing psychology, artificial intelligence, neuroscience and linguistics
- To appreciate the basics of cognitive Psychology
- To understand the role of Neuro science in Cognitive field

UNIT I INTRODUCTION TO COGNITIVE SCIENCE 9

The Cognitive view –Some Fundamental Concepts – Computers in Cognitive Science – Applied Cognitive Science – The Interdisciplinary Nature of Cognitive Science – Artificial Intelligence: Knowledge representation -The Nature of Artificial Intelligence - Knowledge Representation – Artificial Intelligence: Search, Control, and Learning

UNIT II COGNITIVE PSYCHOLOGY 10

Cognitive Psychology – The Architecture of the Mind - The Nature of Cognitive Psychology- A Global View of The Cognitive Architecture- Propositional Representation- Schematic Representation- Cognitive Processes, Working Memory, and Attention- The Acquisition of Skill- The Connectionist Approach to Cognitive Architecture

UNIT III COGNITIVE NEUROSCIENCE 8

Brain and Cognition Introduction to the Study of the Nervous System – Neural Representation – Neuropsychology- Computational Neuroscience - The Organization of the mind - Organization of Cognitive systems - Strategies for Brain mapping – A Case study: Exploring mindreading

UNIT IV LANGUAGE ACQUISITION, SEMANTICS AND PROCESSING MODELS 10

Language Acquisition: Milestones in Acquisition – Theoretical Perspectives- Semantics and Cognitive Science – Meaning and Entailment – Reference – Sense – Cognitive and Computational Models of Semantic Processing – Information Processing Models of the Mind- Physical symbol systems and language of thought- Applying the Symbolic Paradigm- Neural networks and distributed information processing- Neural network models of Cognitive Processes

UNIT V HIGHER-LEVEL COGNITION 8

Reasoning – Decision Making – Computer Science and AI: Foundations & Robotics – New Horizons - Dynamical systems and situated cognition- Challenges – Emotions and Consciousness – Physical and Social Environments - Applications

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain, and analyze the major concepts, philosophical and theoretical perspectives, empirical findings, and historical trends in cognitive science, related to cultural diversity and living in a global community.
- Use cognitive science knowledge base to create their own methods for answering novel questions of either a theoretical or applied nature, and to critically evaluate the work of others in the same domain
- Proficient with basic cognitive science research methods, including both theory-driven and applied research design, data collection, data analysis, and data interpretation.

REFERENCES:

1. Cognitive Science: An Introduction, Second Edition by Neil Stillings, Steven E. Weisler, Christopher H. Chase and Mark H. Feinstein ,1995
2. Cognitive Science: An Introduction to the Science of the Mind ,José Luis Bermúdez, Cambridge University Press, New York,2010
3. Cognitive Psychology, Robert L. Solso, Otto H. MacLin and M. Kimberly MacLin, 2007, Pearson Education
4. Cognitive Science: An Introduction to the Study of Mind (2006) by J. Friedenberg and G. Silverman
5. How the mind works,Steven Pinker,2009
6. Cognitive Science: An Interdisciplinary Approach by Carolyn Panzer Sobel and Paul Li, 2013
7. Mind: Introduction to Cognitive Science, Paul Thagard, 2nd Edition, MIT Press, 2005

CP8011 INFORMATION RETRIEVAL TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

- To understand the basics of Information Retrieval with pertinence to modeling, query operations and indexing
- To get an understanding of machine learning techniques for text classification and clustering
- To understand the various applications of Information Retrieval giving emphasis to Multimedia IR, Web Search
- To understand the concepts of digital libraries

UNIT I INTRODUCTION: MOTIVATION 8

Basic Concepts – Practical Issues - Retrieval Process – Architecture - Boolean Retrieval –Retrieval Evaluation – Open Source IR Systems–History of Web Search – Web Characteristics–The impact of the web on IR ––IR Versus Web Search–Components of a Search engine

UNIT II MODELING 10

Taxonomy and Characterization of IR Models – Boolean Model – Vector Model - Term Weighting – Scoring and Ranking –Language Models – Set Theoretic Models - Probabilistic Models – Algebraic Models – Structured Text Retrieval Models – Models for Browsing

UNIT III INDEXING 9

Static and Dynamic Inverted Indices – Index Construction and Index Compression. Searching - Sequential Searching and Pattern Matching. Query Operations -Query Languages – Query Processing - Relevance Feedback and Query Expansion - Automatic Local and Global Analysis – Measuring Effectiveness and Efficiency

UNIT IV TEXT CLASSIFICATION AND NAÏVE BAYES 9

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

UNIT V SEARCHING THE WEB 8

Searching the Web –Structure of the Web –IR and web search – Static and Dynamic Ranking - Web Crawling and Indexing – Link Analysis - XML Retrieval Multimedia IR: Models and Languages – Indexing and Searching Parallel and Distributed IR – Digital Libraries

TOTAL : 45 PERIODS

OUTCOMES:

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

- Build an Information Retrieval system using the available tools
- Identify and design the various components of an Information Retrieval system
- Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval
- Analyze the Web content structure
- Design an efficient search engine

REFERENCES:

1. Ricardo Baeza – Yates, BerthierRibeiro – Neto, Modern Information Retrieval: The concepts and Technology behind Search (ACM Press Books), Second Edition 2011
2. Ricardo Baeza – Yates, BerthierRibeiro – Neto, Modern Information Retrieval, Pearson Education, Second Edition 2005
3. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, Introduction to Information Retrieval, Cambridge University Press, First South Asian Edition 2012
4. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval Implementing and Evaluating Search Engines, The MIT Press, Cambridge, Massachusetts London, England, 2010

CP8012 **INTERNET OF THINGS** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the basics of Internet of Things
- To get an idea of some of the application areas where Internet of Things can be applied
- To understand the middleware for Internet of Things
- To understand the concepts of Web of Things
- To understand the concepts of Cloud of Things with emphasis on Mobile cloud computing
- To understand the IOT protocols

UNIT I INTRODUCTION **10**

Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT –IoT Information Security

UNIT II IOT PROTOCOLS **8**

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus – KNX – Zigbee Architecture – Network layer – APS layer – Security

UNIT III WEB OF THINGS **10**

Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture

UNIT IV INTEGRATED **9**

Integrated Billing Solutions in the Internet of Things Business Models for the Internet of Things - Network Dynamics: Population Models – Information Cascades - Network Effects - Network Dynamics: Structural Models - Cascading Behavior in Networks - The Small-World Phenomenon

UNIT V APPLICATIONS **8**

The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronisation and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging

TOTAL: 45 PERIODS

OUTCOMES:

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

- Identify and design the new models for market strategic interaction
- Design business intelligence and information security for WoB
- Analyze various protocols for IoT
- Design a middleware for IoT
- Analyze and design different models for network dynamics

REFERENCES:

1. The Internet of Things in the Cloud: A Middleware Perspective - Honbo Zhou – CRC Press – 2012
2. Architecting the Internet of Things - Dieter Uckelmann; Mark Harrison; Florian Michahelles- (Eds.) – Springer – 2011
3. Networks, Crowds, and Markets: Reasoning About a Highly Connected World - David Easley and Jon Kleinberg, Cambridge University Press - 2010
4. The Internet of Things: Applications to the Smart Grid and Building Automation by - Olivier Hersent, Omar Elloumi and David Boswarthick - Wiley -2012
5. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012

CP8013 NETWORK ON CHIP L T P C
3 0 0 3

OBJECTIVES:

- To understand the various classes of Interconnection networks.
- To learn about different routing techniques for on-chip network.
- To know the importance of flow control in on-chip network.
- To learn the building blocks of routers.
- To provide an overview of the current state-of-the-art research.

UNIT I ICN ARCHITECTURES 9

Introduction - Classification of ICNs - Topologies - Direct networks - Indirect networks-Performance analysis.

UNIT II SWITCHING TECHNIQUES 9

Basic switching techniques - Virtual channels - Hybrid switching techniques Optimizing switching techniques - Comparison of switching techniques - Deadlock, livelock and Starvation.

UNIT III ROUTING ALGORITHMS 9

Taxonomy of routing algorithms - Deterministic routing algorithms - Partially adaptive algorithms - Fully adaptive algorithms - Routing in MINs - Routing in switch-based networks with irregular topologies - Resource allocation policies- Flow control.

UNIT IV NETWORK-ON-CHIP 9

NoC Architectures - Router architecture - Area, energy and reliability constraints - NoC design lternatives - Quality-of Service (QoS) issues in NoC architectures

UNIT V EMERGING TRENDS 9

Fault-tolerance issues - Emerging on-chip interconnection technologies- 3D NoC- Simulation.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Identify the major components required to design an on-chip network.
- Compare different switching techniques.
- Evaluate the performance and the cost of the given on-chip network.
- Demonstrate deadlock-free and livelock free routing protocols.
- Simulate and assess the performance of a given on-chip network.

REFERENCES:

1. J. Duato, S. Yalamanchili, and Lionel Ni, "Interconnection Networks: An Engineering Approach", Morgan Kaufmann Publishers 2004.
2. William James Dally and Brian Towles, "Principles and Practices of Interconnection Networks", ISBN: 0122007514, Morgan Kaufmann, 2003.
3. Giovanni De Micheli and Luca Benini, "Networks on Chips: Technology and Tools", ISBN: 0123705215, Morgan Kaufmann, 2006
4. Natalie Enright Jerger and Li-Shiuan Peh, “On-ChipNetworks”, Synthesis lectures on computer architecture #8, Morgan and Claypool Publishers 2009.
5. Fayez Gebali, Haytham Elmiligi, Mohamed Wathed and El-Kharashi “Networks-on-Chips: Theory and Practice”, CRC Press, Taylor and Francis Group 2009.

CP8014 SECURE NETWORK SYSTEM DESIGN L T P C
3 0 0 3

OBJECTIVES:

- Understand security best practices and how to take advantage of the networking gear that is already available
- Learn design considerations for device hardening, Layer 2 and Layer 3 security issues, denial of service, IPSec VPNs, and network identity
- Understand security design considerations for common applications such as DNS, mail, and web
- Identify the key security roles and placement issues for network security elements such as firewalls, intrusion detection systems, VPN gateways, content filtering, as well as for traditional network infrastructure devices such as routers and switches.
- Understand the various testing and optimizations strategies to select the technologies and devices for secure network design.

UNIT I NETWORK SECURITY FOUNDATIONS 9

Secure network design through modeling and simulation, A fundamental framework for network security, need for user level security on demand, Network Security Axioms, security policies and operations life cycle, security networking threats, network security technologies, general and identity design considerations, network security platform options and best deployment practices, secure network management and network security management.

UNIT II IDENTIFYING SYSTEM DESIGNER’S NEEDS AND GOALS 9

Evolution of network security and lessons learned from history, Analyzing top-down network design methodologies, technical goals and tradeoffs – scalability, reliability, availability, Network performance, security, Characterizing the existing internetwork, characterizing network traffic, developing network security strategies.

UNIT III PHYSICAL SECURITY ISSUES AND LAYER 2 SECURITY CONSIDERATIONS 9

Control physical access to facilities, Control physical access to data centers, Separate identity mechanisms for insecure locations, Prevent password-recovery mechanisms in insecure locations, awareness about cable plant issues, electromagnetic radiation and physical PC security threats, L2 control protocols, MAC flooding considerations, attack mitigations, VLAN hopping attacks, ARP, DHCP, PVLAN security considerations, L2 best practice policies.

UNIT IV IP ADDRESSING AND ROUTING DESIGN CONSIDERATIONS 9

Route summarizations, ingress and egress filtering, Non routable networks, ICMP traffic management, Routing protocol security, Routing protocol authentication, transport protocol management policies, Network DoS/flooding attacks.

UNIT V TESTING AND OPTIMIZING SYSTEM DESIGN 9

Selecting technologies and devices for network design, testing network design – using industry tests, building a prototype network system, writing and implementing test plan, tools for testing, optimizing network design – network performance to meet quality of service (QoS), Modeling, simulation and behavior analysis of security attacks, future issues in information system security.

TOTAL: 45 PERIODS

OUTCOMES:

Follows the best practices to understand the basic needs to design secure network.

- Satisfy the need for user and physical level security on demand for various types of network attacks.
- Uses best practice policies for different network layers protocols.
- Understand the network analysis, simulation, testing and optimizing of security attacks to provide Quality of Service.

REFERENCES:

1. Sumit Ghosh, “Principles of secure network system design”, Springer-Verlag, NY,2002.(UNIT I)
2. Sean Convery, “Network security architecture”, Cisco Press, 2004.(UNIT III & IV)
3. Priscilla Oppenheimer, “Top-Down network Design”, Thrid edition, Cisco press, 2012. (UNIT II & V).
4. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fourth Edition, Morgan Kauffmann Publishers Inc., 2009, Elsevier.
5. William Stallings, “Crpyptography and Network security Principles and Practices”, Pearson / PHI, 4th edition, 2006.
6. Wade Trappe, Lawrence C Washington, “Introduction to Cryptography with coding theory”, 2nd edition, Pearson, 2007.

CP8015 TEXT DATA MINING L T P C
3 0 0 3

OBJECTIVES:

- To understand the basic issues and types of text mining
- To appreciate the different aspects of text categorization and clustering
- To understand the role played by text mining in Information retrieval and extraction
- To appreciate the use of probabilistic models for text mining
- To appreciate the current trends in text mining

UNIT I INTRODUCTION 8

Overview of text mining- Definition- General Architecture– Algorithms– Core Operations – Pre-processing– Types of Problems- basics of document classification- information retrieval- clustering and organizing documents- information extraction- prediction and evaluation-Textual information to numerical vectors -Collecting documents- document standardization- tokenization- lemmatization- vector generation for prediction- sentence boundary determination -evaluation performance

UNIT II TEXT CATEGORIZATION AND CLUSTERING 10

Text Categorization – Definition – Document Representation –Feature Selection - Decision Tree Classifiers - Rule-based Classifiers - Probabilistic and Naive Bayes Classifiers - Linear Classifiers- Classification of Linked and Web Data - Meta-Algorithms– Clustering –Definition- Vector Space Models - Distance-based Algorithms- Word and Phrase-based Clustering -Semi-Supervised Clustering - Transfer Learning

UNIT III TEXT MINING FOR INFORMATION RETRIEVAL AND INFORMATION EXTRACTION 10

Information retrieval and text mining- keyword search- nearest-neighbor methods- similarity- web-based document search- matching- inverted lists- evaluation. Information extraction- Architecture - Co-reference - Named Entity and Relation Extraction- Template filling and database construction – Applications. Inductive -Unsupervised Algorithms for Information Extraction. Text Summarization Techniques - Topic Representation - Influence of Context - Indicator Representations - Pattern Extraction - Apriori Algorithm – FP Tree algorithm

UNIT IV PROBABILISTIC MODELS 9

Probabilistic Models for Text Mining -Mixture Models - Stochastic Processes in Bayesian Nonparametric Models - Graphical Models - Relationship Between Clustering, Dimension Reduction and Topic Modeling - Latent Semantic Indexing - Probabilistic Latent Semantic Indexing -Latent Dirichlet Allocation- Interpretation and Evaluation - Probabilistic Document Clustering and Topic Models - Probabilistic Models for Information Extraction - Hidden Markov Models - Stochastic Context-Free Grammars - Maximal Entropy Modeling - Maximal Entropy Markov Models -Conditional Random Fields

UNIT V RECENT TRENDS 8

Visualization Approaches - Architectural Considerations - Visualization Techniques in Link Analysis - Example- Mining Text Streams - Text Mining in Multimedia - Text Analytics in Social Media - Opinion Mining and Sentiment Analysis - Document Sentiment Classification - Opinion Lexicon Expansion - Aspect-Based Sentiment Analysis - Opinion Spam Detection – Text Mining Applications and Case studies

TOTAL: 45 PERIODS

OUTCOMES:

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

- Identify the different features that can be mined from text and web documents
- Use available open source classification and clustering tools on some standard text data sets
- Modify existing classification/clustering algorithms in terms of functionality or features used
- Design a system that uses text mining to improve the functions of an existing open source search engine
- Implement a text mining system that can be used for an application of your choice

REFERENCES:

1. Sholom Weiss, Nitin Indurkhya, Tong Zhang, Fred Damerau “The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data”, Springer, paperback 2010
2. Ronen Feldman, James Sanger -“ The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data”-Cambridge University press, 2006.
3. Charu C. Aggarwal ,ChengXiang Zhai**,** Mining Text Data, Springer; 2012

CP8016 **WEB DATA MINING** **L T P C**
3 0 0 3

OBJECTIVES:

- To focus on a detailed overview of the data mining process and techniques, specifically those that are relevant to Web mining
- To Understand the basics of Information retrieval and Web search with special emphasis on web Crawling
- To appreciate the use of machine learning approaches for Web Content Mining
- To understand the role of hyper links in web structure mining
- To appreciate the various aspects of web usage mining

UNIT I INTRODUCTION **8**

Introduction – Web Mining – Theoretical background –Algorithms and techniques – Association rule mining – Sequential Pattern Mining -Information retrieval and Web search – Information retrieval Models-Relevance Feedback- Text and Web page Pre-processing – Inverted Index – Latent Semantic Indexing – Web Search – Meta-Search – Web Spamming

UNIT II WEB CONTENT MINING **10**

Web Content Mining – Supervised Learning – Decision tree - Naïve Bayesian Text Classification - Support Vector Machines - Ensemble of Classifiers. Unsupervised Learning - K-means Clustering - Hierarchical Clustering –Partially Supervised Learning – Markov Models - Probability-Based Clustering - Evaluating Classification and Clustering – Vector Space Model – Latent semantic Indexing – Automatic Topic Extraction - Opinion Mining and Sentiment Analysis - Document Sentiment Classification

UNIT III WEB LINK MINING **9**

Web Link Mining – Hyperlink based Ranking – Introduction -Social Networks Analysis- Co-Citation and Bibliographic Coupling - Page Rank -Authorities and Hubs -Link-Based Similarity Search - Enhanced Techniques for Page Ranking - Community Discovery – Web Crawling -A Basic Crawler Algorithm- Implementation Issues- Universal Crawlers- Focused Crawlers- Topical Crawlers- Evaluation - Crawler Ethics and Conflicts - New Developments

UNIT IV STRUCTURED DATA EXTRACTION **8**

Structured Data Extraction: Wrapper Generation – Preliminaries- Wrapper Induction- Instance-Based Wrapper Learning ·- Automatic Wrapper Generation: Problems - String Matching and Tree Matching -. Multiple Alignment - Building DOM Trees - Extraction Based on a Single List Page and Multiple pages- Introduction to Schema Matching - Schema-Level Match -Domain and Instance-Level Matching – Extracting and Analyzing Web Social Networks.

UNIT V WEB USAGE MINING **10**

Web Usage Mining - Click stream Analysis -Web Server Log Files - Data Collection and Pre-Processing - Cleaning and Filtering- Data Modeling for Web Usage Mining - The BIRCH Clustering Algorithm -Affinity Analysis and the A Priori Algorithm – Binning. Discovery and Analysis of Web Usage Patterns – Modeling user interests –Probabilistic Latent Semantic Analysis – Latent Dirichlet Allocation Model– Applications- Collaborative Filtering- Recommender Systems – Web Recommender systems based on User and Item – PLSA and LDA Models

TOTAL: 45 PERIODS

OUTCOMES:

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

- Build a sample search engine using available open source tools
- Identify the different components of a web page that can be used for mining
- Apply machine learning concepts to web content mining
- Implement Page Ranking algorithm and modify the algorithm for mining information
- Process data using the Map Reduce paradigm
- Design a system to harvest information available on the web to build recommender systems
- Analyze social media data using appropriate data/web mining techniques
- Modify an existing search engine to make it personalized

REFERENCES:

1. Bing Liu, " Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data (Data-Centric Systems and Applications)", Springer; 2nd Edition 2009
2. Guandong Xu ,Yanchun Zhang, Lin Li, "Web Mining and Social Networking: Techniques and Applications", Springer; 1st Edition.2010
3. Zdravko Markov, Daniel T. Larose, "Data Mining the Web: Uncovering Patterns in Web Content, Structure, and Usage", John Wiley & Sons, Inc., 2007
4. Soumen Chakrabarti, "Mining the Web: Discovering Knowledge from Hypertext Data", Morgan Kaufmann; edition 2002
5. Adam Schenker, "Graph-Theoretic Techniques for Web Content Mining", World Scientific Pub Co Inc , 2005
6. Min Song, Yi Fang and Brook Wu, Handbook of research on Text and Web mining technologies, IGI global, information Science Reference – imprint of :IGI publishing, 2008.

CP8073 DATAMINING TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

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

UNIT I INTRODUCTION TO DATA WAREHOUSING 8

Evolution of Decision Support Systems- Data warehousing Components – Building a Data warehouse, Data Warehouse and DBMS, Data marts, Metadata, Multidimensional data model, OLAP vs OLTP, OLAP operations, Data cubes, Schemas for Multidimensional Database: Stars, Snowflakes and Fact constellations

UNIT II DATA WAREHOUSE PROCESS AND ARCHITECTURE 9

Types of OLAP servers, 3–Tier data warehouse architecture, distributed and virtual data warehouses.Data warehouse implementatio, tuning and testing of data warehouse. Data Staging (ETL) Design and Development, data warehouse visualization, Data Warehouse Deployment, Maintenance, Growth, Business Intelligence Overview- Data Warehousing and Business Intelligence Trends - Business Applications- tools-SAS

UNIT III INTRODUCTION TO DATA MINING 9

Data mining-KDD versus datamining, Stages of the Data Mining Process-task premitives, Data Mining Techniques -Data mining knowledge representation – Data mining query languages, Integration of a Data Mining System with a Data Warehouse – Issues, Data preprocessing – Data cleaning, Data transformation, Feature selection, Dimensionality reduction, Discretization and generating concept hierarchies-Mining frequent patterns- association-correlation

UNIT IV CLASSIFICATION AND CLUSTERING 10

Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Clustering techniques – , Partitioning methods- k-means- Hierarchical Methods – distance based agglomerative and divisible clustering, Density-Based Methods – expectation maximization -Grid Based Methods – Model-Based Clustering Methods – Constraint – Based Cluster Analysis – Outlier Analysis

UNIT V PREDICTIVE MODELING OF BIG DATA AND TRENDS IN DATAMINING 9

Statistics and Data Analysis – EDA – Small and Big Data –Logistic Regression Model - Ordinary Regression Model-Mining complex data objects – Spatial databases – Temporal databases – Multimedia databases – Time series and sequence data – Text mining – Web mining – Applications in Data mining

TOTAL: 45 PERIODS

OUTCOMES:

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

- Evolve Multidimensional Intelligent model from typical system
- Discover the knowledge imbibed in the high dimensional system
- Evaluate various mining techniques on complex data objects

TEXT BOOKS:

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

REFERENCES:

1. Mehmed kantardzic,"Datamining concepts,models,methods, and algorithms", Wiley Interscience, 2003.
2. Ian Witten, Eibe Frank, Data Mining; Practical Machine Learning Tools and Techniques, third edition, Morgan Kaufmann, 2011.
3. George M Marakas, Modern Data Warehousing, Mining and Visualization,Prentice Hall, 2003.

CP8075 SOCIAL NETWORK ANALYSIS L T P C
3 0 0 3

OBJECTIVES:

- To gain knowledge about the current Web development and emergence of Social Web.
- To study about the modeling, aggregating and knowledge representation of Semantic Web.
- To learn about the extraction and mining tools for Social networks.
- To gain knowledge on Web personalization and Web Visualization of Social networks.

UNIT I INTRODUCTION TO SOCIAL NETWORK ANALYSIS 8

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

UNIT II MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION 8

Ontology and their role in the Semantic Web - Ontology-based Knowledge Representation - Ontology languages for the Semantic Web – RDF and OWL **-** Modelling and aggregating social network data **-** State-of-the-art in network data representation, Ontological representation of social individuals, Ontological representation of social relationships, Aggregating and reasoning with social network data, Advanced Representations.

UNIT III EXTRACTION AND MINING COMMUNITITES IN WEB SOCIAL NETWROKS 10

Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Definition of Community - Evaluating Communities - Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Tools for Detecting Communities Social Network Infrastructures and Communities - Decentralized Online Social Networks- Multi-Relational Characterization of Dynamic Social Network Communities.

UNIT IV PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES 10

Understanding and Predicting Human Behaviour for Social Communities - User Data Management, Inference and Distribution - Enabling New Human Experiences - Reality Mining - Context-Awareness - Privacy in Online Social Networks - Trust in Online Environment - Trust Models Based on Subjective Logic - Trust Network Analysis - Trust Transitivity Analysis - Combining Trust and Reputation - Trust Derivation Based on Trust Comparisons - Attack Spectrum and Countermeasures.

UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS 8

Graph Theory- Centrality- Clustering - Node-Edge Diagrams, Matrix representation, Visualizing Online Social Networks, Visualizing Social Networks with Matrix-Based Representations- Matrix + Node-Link Diagrams, Hybrid Representations - Applications - Covert Networks - Community Welfare - Collaboration Networks - Co-Citation Networks.

TOTAL:45 PERIODS

OUTCOMES:

- To apply knowledge for current Web development in the era of Social Web.
- To model, aggregate and represent knowledge for Semantic Web.
- To design extraction and mining tools for Social networks.
- To develop personalized web sites and visualization for Social networks.

REFERENCES:
1. Peter Mika, "Social networks and the Semantic Web", Springer, 1st edition 2007.
2. Borko Furht, "Handbook of Social Network Technologies and Applications", Springer, 1st edition, 2010.
3. Guandong Xu , Yanchun Zhang and Lin Li, "Web Mining and Social Networking Techniques and applications", Springer, 1st edition, 2011.
4. Dion Goh and Schubert Foo, "Social information retrieval systems: emerging technologies and applications for searching the Web effectively", IGI Global snippet, 2008.
5. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and social information retrieval and access: techniques for improved user modelling", IGI Global snippet, 2009.
6. John G. Breslin, Alexandre Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.

IF8078 IMAGE PROCESSING L T P C
3 0 0 3

OBJECTIVES:
- To understand the basic concepts of digital image processing and various image transforms.
- To familiarize the student with the image processing facilities in Matlab.
- To expose the student to a broad range of image processing techniques and their applications, and to provide the student with practical experience using them.
- To appreciate the use of current technologies those are specific to image processing systems.
- To expose the students to real-world applications of image processing.

UNIT I FUNDAMENTALS OF IMAGE PROCESSING AND IMAGE TRANSFORMS 9

Introduction – Steps in Digital Image Processing – Image sampling and Quantization – Basic relationships between pixels – Color Fundamentals – File Formats – Image Transforms: DFT, DCT, Haar, SVD and KL- Introduction to Matlab Toolbox.

UNIT II IMAGE ENHANCEMENT AND IMAGE RESTORATION 9

Image Enhancement in the Spatial Domain: Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, SpatialFiltering , **Fuzzy sets for spatial filters** – Image Enhancement in the Frequency Domain: Frequency Domain Filters - Image Restoration: Model of Image Degradation/Restoration Process, Noise Models, **Linear and non linear image restoration techniques, Blind Deconvolution**

UNIT III MULTI RESOLUTION ANALYSIS AND IMAGE COMPRESSION 9

Multi Resolution Analysis: Image Pyramids – Multi resolution expansion – Fast Wavelet Transforms, **Lifting scheme**. Image Compression: Fundamentals – Models – Elements of Information Theory – Error Free Compression – Lossy Compression-**wavelet based image compression techniques** – Compression standards-JPEG/MPEG, Video compression.

UNIT IV IMAGE SEGMENTATION AND DESCRIPTION 9

Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region Based Segmentation, Basic Morphological Algorithms, Morphological Water Sheds - Description: Boundary Descriptors, Regional Descriptors.

UNIT V CURRENT TRENDS AND APPLICATIONS OF IMAGE PROCESSING 9

Applications: Image Classification, Object Recognition, Image Fusion, Steganography – Current Trends: Color Image Processing, Wavelets in Image Processing.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students

- Should have a clear impression of the breadth and practical scope of digital image processing and have arrived at a level of understanding that is the foundation for most of the work currently underway in this field.
- Implement basic image processing algorithms using MATLAB tools
- Explore advanced topics of Digital Image Processing.4
- Ability to Apply and develop new techniques in the areas of image enhancement- restoration-segmentation- compression-wavelet processing and image morphology.
- Make a positive professional contribution in the field of Digital Image Processing.

REFERENCES:

1. Rafael C.Gonzalez and Richard E.Woods, “Digital Image Processing”, Pearson Education, Third Edition, 2008.
2. S. Sridhar, “Digital Image Processing”, Oxford University Press, 2011.
3. Milan Sonka, Vaclav Hlavac and Roger Boyle, “Image Processing, Analysis and Machine Vision”, Second Edition, Thomson Learning, 2001.
4. Anil K.Jain, “Fundamentals of Digital Image Processing”, PHI, 2006.
5. Sanjit K. Mitra, & Giovanni L. Sicuranza, “Non Linear Image Processing”, Elsevier, 2007.
6. Rafael C.Gonzalez, Richard E.Woods, and Eddins, “Digital Image Processing Using MATLAB”, Tata McGraw-Hill, Second Edition, 2009.

CP8017 AD HOC AND WIRELESS SENSOR NETWORKS L T P C
3 0 0 3

OBJECTIVES:

- To learn about the issues in the design of wireless ad hoc networks
- To understand the working of protocols in different layers of mobile ad hoc and sensor networks
- To expose the students to different aspects in sensor networks
- To understand various security issues in ad hoc and sensor networks and solutions to the issues

UNIT I MAC & ROUTING IN AD HOC NETWORKS 9

Introduction – Issues and challenges in ad hoc networks – MAC Layer Protocols for wireless ad hoc networks – Contention-Based MAC protocols – MAC Protocols Using Directional Antennas – Multiple-Channel MAC Protocols – Power-Aware MAC Protocols – Routing in Ad hoc Networks – Design Issues – Proactive, Reactive and Hybrid Routing Protocols

UNIT II TRANSPORT & QOS IN AD HOC NETWORKS 9

TCP’s challenges and Design Issues in Ad Hoc Networks – Transport protocols for ad hoc networks – Issues and Challenges in providing QoS – MAC Layer QoS solutions – Network Layer QoS solutions – QoS Model

UNIT III MAC & ROUTING IN WIRELESS SENSOR NETWORKS 9

Introduction – Applications – Challenges – Sensor network architecture – MAC Protocols for wireless sensor networks – Low duty cycle protocols and wakeup concepts – Contention-Based protocols – Schedule-Based protocols – IEEE 802.15.4 Zig bee – Topology Control – Routing Protocols

UNIT IV TRANSPORT & QOS IN WIRELESS SENSOR NETWORKS 9

Data-Centric and Contention-Based Networking – Transport Layer and QoS in Wireless Sensor Networks – Congestion Control – In-network processing – Operating systems for wireless sensor networks – Examples

UNIT V SECURITY IN AD HOC AND SENSOR NETWORKS 9

Security Attacks – Key Distribution and Management – Intrusion Detection – Software based Anti-tamper techniques – Water marking techniques – Defense against routing attacks - Secure Ad hoc routing protocols – Broadcast authentication WSN protocols – TESLA – Biba – Sensor Network Security Protocols – SPINS

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course students should be able to

- Identify different issues in wireless ad hoc and sensor networks
- To analyze protocols developed for ad hoc and sensor networks
- To identify and understand security issues in ad hoc and sensor netoworks

REFERENCES:

1. Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, “Ad Hoc Mobile Wireless Networks”, Auerbach Publications, 2008.
2. Holger Karl, Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley & Sons, Inc., 2005.
3. Erdal Çayırcı , Chunming Rong, “Security in Wireless Ad Hoc and Sensor Networks”, John Wiley and Sons, 2009.
4. C.Siva Ram Murthy and B.S.Manoj, “Ad Hoc Wireless Networks – Architectures and Protocols”, Pearson Education, 2004.
5. Carlos De Morais Cordeiro, Dharma Prakash Agrawal, “Ad Hoc and Sensor Networks: Theory and Applications (2nd Edition)”, World Scientific Publishing, 2011.
6. Waltenegus Dargie, Christian Poellabauer, “Fundamentals of Wireless Sensor Networks Theory and Practice”, John Wiley and Sons, 2010
7. Adrian Perrig, J. D. Tygar, "Secure Broadcast Communication: In Wired and Wireless Networks", Springer, 2006.

CP8018 BIG DATA ANALYTICS L T P C

3 0 0 3

OBJECTIVES:

- To understand big data analytics as the next wave for businesses looking for competitive advantage
- To understand the financial value of big data analytics
- To explore tools and practices for working with big data
- To understand how big data analytics can leverage into a key component
- To understand how to mine the data
- To learn about stream computing
- To know about the research that requires the integration of large amounts of data

UNIT I INTRODUCTION TO BIG DATA 9

Analytics – Nuances of big data – Value – Issues – Case for Big data – Big data options Team challenge – Big data sources – Acquisition – Nuts and Bolts of Big data. Features of Big Data - Security, Compliance, auditing and protection - Evolution of Big data – Best Practices for Big data Analytics - Big data characteristics - Volume, Veracity, Velocity, Variety – Data Appliance and Integration tools – Greenplum – Informatica

UNIT II DATA ANALYSIS 9

Evolution of analytic scalability – Convergence – parallel processing systems – Cloud computing – grid computing – map reduce – enterprise analytic sand box – analytic data sets – Analytic methods – analytic tools – Cognos – Microstrategy - Pentaho. Analysis approaches – Statistical significance – business approaches – Analytic innovation – Traditional approaches – Iterative

UNIT III STREAM COMPUTING 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 - Realtime Analytics Platform(RTAP) applications IBM Infosphere – Big data at rest – Infosphere streams – Data stage – Statistical analysis – Intelligent scheduler – Infosphere Streams

UNIT IV PREDICTIVE ANALYTICS AND VISUALIZATION 9

Predictive Analytics – Supervised – Unsupervised learning – Neural networks – Kohonen models – Normal – Deviations from normal patterns – Normal behaviours – Expert options – Variable entry - Mining Frequent itemsets - Market based model – Apriori Algorithm – Handling large data sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream – Clustering Techniques – Hierarchical – K- Means – Clustering high dimensional data Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications:

UNIT V FRAMEWORKS AND APPLICATIONS 9

IBM for Big Data – Map Reduce Framework - Hadoop – Hive - – Sharding – NoSQL Databases - S3 - Hadoop Distributed file systems – Hbase – Impala – Analyzing big data with twitter – Big data for E-Commerce – Big data for blogs.

TOTAL : 45 PERIODS

OUTCOMES:

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

- Identify the need for big data analytics for a domain
- Use Hadoop, Map Reduce Framework
- Apply big data analytics for a give problem
- Suggest areas to apply big data to increase business outcome
- Contextually integrate and correlate large amounts of information automatically to gain faster insights.

REFERENCES:

1. Frank J Ohlhorst, “Big Data Analytics: Turning Big Data into Big Money”, Wiley and SAS Business Series, 2012.
2. Colleen Mccue, “Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis”, Elsevier, 2007
3. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
4. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012.

5. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, Wiley and SAS Business Series, 2012.
6. Paul Zikopoulos, Chris Eaton, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGraw Hill, 2011.
7. Paul Zikopoulos, Dirk deRoos, Krishnan Parasuraman, Thomas Deutsch , James Giles, David Corrigan, “Harness the Power of Big data – The big data platform”, McGraw Hill, 2012.
8. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007
9. Pete Warden, Big Data Glossary, O’Reilly, 2011.
10. Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, Second Edition, Elsevier, Reprinted 2008.

CP8019 **ETHICAL HACKING AND DIGITAL FORENSICS** **L T P C**
3 0 0 3

OBJECTIVES:

- To learn various hacking techniques and attacks.
- To know how to protect data assets against attacks from the Internet.
- To assess and measure threats to information assets.
- To understand the benefits of strategic planning process.
- To evaluate where information networks are most vulnerable.
- To perform penetration tests into secure networks for evaluation purposes.
- To enable students to understand issues associated with the nature of forensics.

UNIT I HACKING WINDOWS **9**

Hacking windows – Network hacking – Web hacking – Password hacking. A study on various attacks – Input validation attacks – SQL injection attacks – Buffer overflow attacks - Privacy attacks.

UNIT II TCP/IP **9**

TCP / IP – Checksums – IP Spoofing port scanning, DNS Spoofing. Dos attacks – SYN attacks, Smurf attacks, UDP flooding, DDOS – Models. Firewalls – Packet filter firewalls, Packet Inspection firewalls – Application Proxy Firewalls. Batch File Programming.

UNIT III FUNDAMENTALS OF COMPUTER FRAUD **9**

Fundamentals of Computer Fraud – Threat concepts – Framework for predicting inside attacks – Managing the threat – Strategic Planning Process.

UNIT IV ARCHITECTURE **9**

Architecture strategies for computer fraud prevention – Protection of Web sites – Intrusion detection system – NIDS, HIDS – Penetrating testing process – Web Services– Reducing transaction risks.

UNIT V KEY FRAUD INDICATOR SELECTION PROCESS CUSTOMIZED **9**

Forensics – Computer Forensics – Journaling and it requirements – Standardized logging criteria – Journal risk and control matrix – Neural networks – Misuse detection and Novelty detection.

TOTAL: 45 PERIODS

OUTCOMES:

- On completion of this course, a student should be able to:
- Defend hacking attacks and protect data assets.
- Defend a computer against a variety of different types of security attacks using a number of hands-on techniques.
- Defend a LAN against a variety of different types of security attacks using a number of hands-on techniques.
- Practice and use safe techniques on the World Wide Web.
- Understand computer Digital forensics.

REFERENCES:

1. Kenneth C.Brancik "Insider Computer Fraud" Auerbach Publications Taylor & Francis Group– 2008.
2. Ankit Fadia " Ethical Hacking" second edition Macmillan India Ltd, 2006

CP8020 PARALLEL AND DISTRIBUTED DATABASES L T P C
3 0 0 3

OBJECTIVES :

- To realize the need of parallel processing, to cater the applications that require a system capable of sustaining trillions of operations per second on very large data sets
- To understand the need of data integration over data centralization

UNIT I INTRODUCTION TO PARALLEL DATABASES 9

Need of Parallelism - Forms of parallelism – architecture – Analytical models. Basic Query Parallelism – Parallel Search- Parallel sort and Group By- Parallel Join

UNIT II ADVANCED QUERY PROCESSING IN PARALLEL DATABASES 9

Parallel indexing. Parallel Universal Qualification – Collection Join Queries. Parallel Query Scheduling – Optimization, Applications

UNIT III INTRODUCTION TO DISTRIBUTED DATABASES 9

Overview - Promises of DDB –Design Issues – DDB Design – DDB Integration – Data and Access Control.

UNIT IV QUERY PROCESSING IN DISTRIBUTED DATABASES 9

Overview- of Query Processing – Query Decomposition and Data Localization – Optimization of Distributed Queries, Multi-database Query Processing.

UNIT V TRANSACTION MANAGEMENT AND OTHER ADVANCED SYSTEMS 9

Introduction – Concurrency Control - Distributed DBMS Reliability – Data Replication – DDB Applications, Distributed Object Database Management – Peer -to-Peer Data Management - Web Data Management – Streaming Data and Cloud Computing.

TOTAL: 45 PERIODS

OUTCOMES:

STUDENTS WILL

- Get good knowledge on the need, issues ,design and application of both parallel and distributed databases.
- Know how to write optimal queries to cater applications of that need these forms of databases
- Be able to fragment, replicate and localize their data as well as their queries to get their work done faster
- Get idea on other similar trends of optimal data processing

TEXT BOOKS :

1. David Taniar, Clement H.C.Leung, Wenny Rahayu, Sushant Goel , "High performance parallel Database processing and Grid databases" , John Wiley & Sons, Wiley Series in Parallel and Distributed Computing, 2008.
2. M. Tamer Ozsu and Patrick Valduriez, "Principles of Distributed Database Systems", Springer Science + Business Media , 3rd Edition, 2011.

CP8021 STATISTICAL NATURAL LANGUAGE PROCESSING L T P C
3 0 0 3

OBJECTIVES:

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

UNIT I MORPHOLOGY AND PART-OF SPEECH PROCESSING 9

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

UNIT II SPEECH PROCESSING 9

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

UNIT III SYNTAX ANALYSIS 9

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

UNIT IV SEMANTIC AND PRAGMATIC INTERPRETATION 9

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

UNIT V APPLICATIONS 9

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

TOTAL : 45 PERIODS

OUTCOMES:

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

- To identify the different linguistic components of given sentences
- To design a morphological analyser for a language of your choice using finite state automata concepts
- To implement the Earley algorithm for a language of your choice by providing suitable
- grammar and words
- To use a machine learning algorithm for word sense disambiguation
- To build a tagger to semantically tag words using WordNet
- To design a business application that uses different aspects of language processing.

REFERENCES:

1. Jurafsky and Martin, “Speech and Language Processing”, Pearson Prentice Hall; 2 edition 2008
2. Christopher D. Manning and Hinrich Schütze, ‘Foundations of Statistical Natural Language Processing”, MIT Press, 1999
3. Stevan Bird, “Natural Language Processing with Python”, O'Reilly Media; 1 edition2009
4. Natural Language Understanding (2nd Edition) [Paperback], Addison- Wesley; 2 edition, 1994
5. Nitin Indurkhya, Fred J. Damerau, “Handbook of Natural Language Processing, Second Edition” (Chapman & Hall/CRC Machine Learning & Pattern Recognition), 2010
6. Alexander Clark, Chris Fox, Shalom Lappin, “The Handbook of Computational Linguistics and Natural Language Processing” Wiley-Blackwell; 1 edition, 2010

CP8022 **WEB SERVICES** **L T P C**
3 0 0 3

OBJECTIVES:

- To learn the basics of XML technology.
- To understand the background of distributed information system.
- To analyze and design a web service based application.
- To learn the security features of web services and service composition.

UNIT I DISTRIBUTED INFORMATION SYSTEM 9

Distributed information system – Design of IB – Architecture of IB – Communication in an IS – Middleware RPC – TP monitors – Object brokers – Message oriented middleware – EAI – EAI Middleware – Workflow –Management – benefits and limitations – Web technologies for Application Integration.

UNIT II WEB SERVICES BUILDING BLOCK 9

Web Services – Definition – Web Services and EAI – Web Services Technologies – XML basics - web services Architecture – SOAP – WSDL – UDDI –WS – Addressing – WS – Routing – Web service implementation – Java based web services - .NET based web services.

UNIT III WEB SERVICE SECURITY 9

XML signature – XML Encryption – SAML - XKMS – WS- Security –WS Policy –Web service security framework – .NET and passport – UDDI and security - web service security in java – mobile web service security.

UNIT IV SEMANTIC WEB SERVICES 9

Semantic web service – architecture – RDF Data model – RDF schema – OWL – ontology – role of ontology in web services - semantic Web service implementation issues .

UNIT V SERVICE COMPOSITION 9

Service Coordination and Composition coordination protocols – WS – Coordination – WS – transaction – WSCI – Service Composition – Service Composition Models – Dependencies between coordination and composition – BPEL – Current trends.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students should be able to:

- Create, validate, parse, and transform XML documents.
- Design a middleware solution based application.
- Develop web services using different technologies.
- Compose set of web services using BPEL.

REFERENCES:

1. Gystavo Alonso, Fabio casasi, Hareemi kuno, vijay machiraju, “web Services – concepts, Architecture and Applications”, Springer, 2004.
2. Ron Schmelzer etal “XML and Web Services”, Pearson Education, 2002.
3. Sandeep chatterjee and james webber,” Developing Enterprise web services: An Architect’s and Guide”, Practice Hall, 2004.
4. Freunk p.coyle,” XML, web Services and the Data Revolution”, Pearson, 2002.
5. Jorge Cardoso,”Semantic Web Services”,2006

CP8071 ADVANCED DATABASE ADMINISTRATION AND TUNING L T P C
3 0 0 3

OBJECTIVES:

At the end of the course the students would be able to

- Design and implement relational database solutions for general applications.
- Develop database scripts for data manipulation and database administration.
- Understand and perform common database administration tasks, such as database monitoring, performance tuning, data transfer, and security.
- To balance the different types of competing resources in the database environment so that the most important applications have priority access to the resources

UNIT I INTRODUCTION TO DATABASE ADMINISTRATION 9

Database Administration - DBA Tasks- Database Design -Performance Monitoring and Tuning – Availability - Database Security and Authorization - Backup and Recovery - Data Integrity- DBMS Release Migration - Types of DBAs - Creating the Database Environment - Choosing a DBMS - DBMS Architectures - DBMS Clustering -DBMS Proliferation - Hardware Issues -Installing the DBMS - DBMS Installation Basics Hardware Requirements -Storage Requirements Memory Requirements Configuring the DBMS - Connecting the DBMS to Supporting Infrastructure Software -Installation Verification - DBMS Environments - Upgrading DBMS Versions and Releases - Fallback Planning Migration Verification

UNIT II DATABASE SECURITY, BACKUP AND RECOVERY 9

Database Users - Granting and Revoking Authority - Types of Privileges - Granting to PUBLIC- Revoking Privileges - Security Reporting - Authorization Roles and Groups - Using Views for Security - Using Stored Procedures for Security Auditing External Security - Job Scheduling and Security - Image Copy Backups - Full vs. Incremental Backups - Database Objects and Backups - DBMS Control - Concurrent Access Issues Backup Consistency - Log Archiving and Backup - DBMS Instance Backup - Designing the DBMS Environment for Recovery - Alternate Approaches to Database Backup - Recovery - Determining Recovery Options Types of Recovery – DBA Tools – DBA Rules of Thumb.

UNIT III FUNDAMENTALS OF TUNING 9

Review of Relational Databases – Relational Algebra – Locking and Concurrency Control – Correctness Consideration – Lock Tuning – Logging and the Recovery Subsystem – Principles of Recovery – Tuning the Recovery Subsystem – Operating Systems Considerations – Hardware Tuning.

UNIT IV INDEX TUNING AND QUERY OPTIMIZATION 9

Types of Queries – Data Structures – B tree – B+ Tree - Hash Structures – Bit Map Indexes – Clustering Indexes – Non Clustering Indexes – Composite Indexes – Hot Tables – Comparison of Indexing and Hashing Techniques. Optimization Techniques - Tuning Relational Systems –- Normalization – Tuning Denormalization – Clustering Two Tables – Aggregate maintenance – Record Layout – Query Cache – Parameter Cache - Query Tuning – Triggers – Client Server Mechanisms – Objects, Application Tools and Performance –Tuning the Application Interface – Bulk Loading Data – Accessing Multiple Databases.

UNIT V TROUBLESHOOTING 9

Query Plan Explainers – Performance Monitors – Event Monitors – Finding “Suspicious” Queries – Analyzing a Query’s Access Plan – Profiling a Query Execution – DBMS Subsystems.

TOTAL: 45 PERIODS

OUTCOMES:

- advanced features of databases in design, administration, and applications
- aspires to improve the performance of a database
- optimize the use of existing resources within the database environment.

REFERENCES:

1. Craig S. Mullins, Database Administration: The Complete Guide to Practices and Procedures, Addison-Wesley Professional, 2002.
2. Dennis Shasha and Philippe Bonnet, Database Tuning, Principles, Experiments and Troubleshooting Techniques, Elsevier Reprint 2005.
3. Silberschatz, Korth, Database System Concepts, McGraw hill, 6th edition, 2010.
4. Thomas Connoly and Carlolyn Begg, Database Systems, A Practical Approach to Design, Implementation and Management, Fourth Edition, Pearson Education 2008.

IF8252 CLOUD COMPUTING TECHNOLOGIES L T P C
3 0 0 3

OBJECTIVES:

- To understand the concept of cloud and utility computing.
- To understand the various issues in cloud computing.
- To familiarize themselves with the state of the art in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.
- To be able to set up a private cloud.

UNIT I INTRODUCTION 8

Evolution of Cloud Computing –System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture -IaaS – On-demand Provisioning – Elasticity in Cloud – E.g. of IaaS Providers - PaaS – E.g. of PaaS Providers - SaaS – E.g. of SaaS Providers – Public , Private and Hybrid Clouds.

UNIT II VIRTUALIZATION 9

Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices - Desktop Virtualization – Server Virtualization.

UNIT III CLOUD INFRASTRUCTURE
9

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.

UNIT IV PROGRAMMING MODEL 10

Parallel and Distributed Programming Paradigms – Map Reduce , Twister and Iterative MapReduce – Hadoop Library from Apache – Mapping Applications - Programming Support -

Google App Engine, Amazon AWS - Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack.

UNIT V SECURITY IN THE CLOUD 9

Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students should be able to:

- Articulate the main concepts, key technologies, strengths and limitations of cloud computing
- Identify the architecture, infrastructure and delivery models of cloud computing
- Explain the core issues of cloud computing such as security, privacy and interoperability
- Choose the appropriate technologies, algorithms and approaches for the related issues

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. John W.Rittinghouse and James F.Ransome, “Cloud Computing: Implementation, Management, and Security”, CRC Press, 2010.
3. Toby Velte, Anthony Velte, Robert Elsenpeter, “Cloud Computing, A Practical Approach”, TMH, 2009.
4. George Reese, “Cloud Application Architectures: Building Applications and Infrastructure in the Cloud” O'Reilly, 2009.
5. James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes”, Elsevier/Morgan Kaufmann, 2005.
6. Katarina Stanoevska-Slabeva, Thomas Wozniak, Santi Ristol, “Grid and Cloud Computing – A Business Perspective on Technology and Applications”, Springer, 2010.