SRI RAMAKRISHNA INSTITUTE OF TECHNOLOGY

(An Autonomous Institution)

(Approved by AICTE, New Delhi :: Affiliated to Anna University, Chennai)

Pachapalayam, Perur Chettipalayam, Coimbatore - 641010

CURRICULUM AND SYLLABI

Designed for

CHOICE BASED CREDIT SYSTEM

Under

PG REGULATION 2017

(For students admitted during 2017 – 2018 and onwards)

M.E. (COMPUTER SCIENCE AND ENGINEERING)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

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CURRICULUM STRUCTURE
M.E. – COMPUTER SCIENCE AND ENGINEERING
(BATCH 2017–2019)

SEMESTER I										
Sl.No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	PICM003	Advanced Mathematics for Computing	ICC	3	1	0	4	40	60	100
2	PCSC001	Advanced Data Structures and Algorithms	PCC	3	0	1	4	40	60	100
3	PCSC004	Big Data Analytics	PCC	3	0	0	3	40	60	100
4	PCSC005	Computer Networks Management	PCC	3	0	1	4	40	60	100
5		Professional Elective 1	PE	3	0	0	3	40	60	100
6		Professional Elective 2	PE	3	0	0	3	40	60	100
			Total	**18**	**1**	**2**	**21**			

SEMESTER II										
Sl.No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	PCSC002	Advanced Database Technology	PCC	3	0	1	4	40	60	100
2	PCSC003	Advanced Operating Systems	PCC	3	0	1	4	40	60	100
3	PCSC006	Fuzzy Logic and Neural Networks	PCC	3	0	0	3	40	60	100
4	PCSC008	Software Quality Assurance and Testing	PCC	3	0	0	3	40	60	100
5		Professional Elective 3	PE	3	0	0	3	40	60	100
6		Professional Elective 4	PE	3	0	0	3	40	60	100
7	PCSO001	Technical Seminar	EEC	0	0	2	1	60	40	100
8	PCSO002	Industrial Internship Training	EEC	0	0	2	1	60	40	100
			Total	**18**	**0**	**6**	**22**			

SEMESTER III										
Sl.No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	PCSC007	Multicore Architectures	PCC	3	0	0	3	40	60	100
2		Professional Elective 5	PE	3	0	0	3	40	60	100
3		Generic Elective	GE	3	0	0	3	40	60	100
4	PCSO003	Project Phase - I	EEC	0	0	6	6	60	40	100
			Total	**9**	**0**	**6**	**15**			

SEMESTER IV										
Sl.No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	PCSO004	Project Phase - II	EEC	0	0	12	12	60	40	100
				0	0	12	12			

LIST OF PROFESSIONAL ELECTIVES

Sl. No	Code	Course Title	Course Type	L	T	P	Total Credits
1	PCSE001	Advanced Computer Architecture	PE	3	0	0	3
2	PCSE002	Advanced Data Mining Techniques	PE	3	0	0	3
3	PCSE003	Biometrics	PE	3	0	0	3
4	PCSE004	Cloud Computing	PE	3	0	0	3
5	PCSE005	Computer Vision	PE	3	0	0	3
6	PCSE006	Concurrency Models	PE	3	0	0	3
7	PCSE007	Data Analysis and Business Synthesis	PE	3	0	0	3
8	PCSE008	Data Visualization Techniques	PE	3	0	0	3
9	PCSE009	Digital Image Processing	PE	3	0	0	3
10	PCSE010	Energy Aware Computing	PE	3	0	0	3
11	PCSE011	Graph Theory	PE	3	0	0	3
12	PCSE012	Information Retrieval Techniques	PE	3	0	0	3
13	PCSE013	Information Storage Management	PE	3	0	0	3
14	PCSE014	Medical Image Processing	PE	3	0	0	3
15	PCSE015	Mobile Adhoc Networks	PE	3	0	0	3
16	PCSE016	Mobile and Pervasive Computing	PE	3	0	0	3
17	PCSE017	Network and Information Security	PE	3	0	0	3
18	PCSE018	Pattern Recognition	PE	3	0	0	3
19	PCSE019	Resource Management Techniques	PE	3	0	0	3
20	PCSE020	Software Process and Project Management	PE	3	0	0	3
21	PCSE021	Software Requirements Engineering	PE	3	0	0	3
22	PCSE022	Speech processing and Synthesis	PE	3	0	0	3
23	PCSE023	Wireless Sensor Networks	PE	3	0	0	3

LIST OF GENERIC ELECTIVES

Sl. No	Code	Course Title	Course Type	L	T	P	Total Credits
1	PPSG001	Robotics	GE	3	0	0	3
2	PCOG002	Applications of MEMS technology	GE	3	0	0	3
3	PMGG003	Intellectual Property Rights	GE	3	0	0	3

SEMESTER I

PICM003	ADVANCED MATHEMATICS FOR COMPUTING	L	T	P	C
		3	1	0	4

Course Objectives

- To gain knowledge about the mathematical concepts applied in cryptography.
- To apply the queuing model concepts in Computer science and Engineering problems.
- To construct linear programming model for real life problems.

Mathematics of Symmetric Key Cryptography

Basic notions – Integer Arithmetic – Modular Arithmetic – Matrices – Congruence and Linear Congruence – Algebraic Structures – GF(2^n) Fields.

Mathematics of Asymmetric Key Cryptography

Primes – Fermat's Little Theorem – Euler Theorem – Primality Testing – Factorization – Chinese Remainder Theorem – Quadratic Congruence.

Queuing Models

Poisson Process – M/M/1, M/M/1/k, M/M/c, M/M/c/k, M/M/∞ queuing Models – Little's formula – Machine Interference Model – Self Service Queue.

Advanced Matrix Theory

Matrix Norms – Jordan Canonical Form – Generalized Eigenvectors – Singular value decomposition – Pseudo inverse – Least Square Approximation – QR Algorithm.

Advanced Linear Programming

Simplex Method Fundamentals – Revised Simplex Method – Bounded-variables Algorithm – Duality – Parametric Linear Programming.

References

1. Forouzan, Behrouz A., and Debdeep Mukhopadhyay, "Cryptography and Network Security ", McGraw-Hill, 2011.
2. Koshy, Thomas., "Elementary number theory with applications", Academic Press, 2007.
3. Gross, Donald., "Fundamentals of queuing theory", John Wiley & Sons, 2011.
4. Taha, Hamdy A., "Operations research: an introduction, Dorling Kindersley (India) Pvt. Ltd", 2014.
5. Sen, Rathindra, "Operations Research: Algorithms and Applications", Prentice Hall of India,2009.

PCSC001	ADVANCED DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	1	4

Course Objectives

- To understand the principles of iterative, recursive algorithms and graph search.
- To study network flow and linear programming problems.
- To develop recursive backtracking algorithms.
- To get an awareness of NP completeness and randomized algorithms.
- To learn the principles of shared and concurrent objects.

Iterative and Recursive Algorithms

Iterative Algorithms: Measures of Progress and Loop Invariants-Paradigm Shift: Sequence of Actions versus Sequence of Assertions- Steps to Develop an Iterative Algorithm-Different Types of Iterative Algorithms--Typical Errors-Recursion-Forward versus Backward- Towers of Hanoi Checklist for Recursive Algorithms-The Stack Frame-Proving Correctness with Strong Induction Examples of Recursive Algorithms-Sorting and Selecting Algorithms-Operations on Integers Ackermann's Function- Recursion on Trees-Tree Traversals- Examples- Generalizing the Problem - Heap Sort and Priority Queues-Representing Expressions.

Optimization Algorithms

Optimization Problems-Graph Search Algorithms-Generic Search-Breadth-First Search-Dijkstra's Shortest-Weighted-Path -Depth-First Search-Recursive Depth-First Search-Linear Ordering of a Partial Order- Network Flows and Linear Programming-Hill Climbing-Primal Dual Hill Climbing Steepest Ascent Hill Climbing-Linear Programming-Recursive Backtracking-Developing Recursive Backtracking Algorithm- Pruning Branches-Satisfiability

Dynamic Programming Algorithms

Developing a Dynamic Programming Algorithm-Subtle Points- Question for the Little Bird Sub-instances and Sub solutions-Set of Substances-Decreasing Time and Space-Number of Solutions-Code Reductions and NP - Completeness – Satisfiability - Proving NP-Completeness- 3-Coloring- Bipartite Matching. Randomized Algorithms - Randomness to Hide Worst Cases Optimization Problems with a Random Structure

Shared Objects and Concurrent Objects

Shared Objects and Synchronization -Properties of Mutual Exclusion-The Mora l-The Producer– Consumer Problem -The Readers–Writers Problem-Realities of Parallelization-Parallel Programming- Principles- Mutual Exclusion-Time- Critical Sections--Thread Solutions-The Filter Lock-Fairness-Lamport's Bakery Algorithm-Bounded Timestamps- Lower Bounds on the Number of Locations-Concurrent Objects- Concurrency and Correctness-Sequential Objects-Quiescent Consistency-

Sequential Consistency-Linearizability- Formal Definitions- Progress Conditions- The Java Memory Model

Concurrent Data Structures

Practice-Linked Lists-The Role of Locking-List-Based Sets-Concurrent Reasoning-Coarse-grained Synchronization-Fine-Grained Synchronization-Optimistic Synchronization- Lazy Synchronization-Non-Blocking Synchronization-Concurrent Queues and the ABA Problem Queues-A Bounded Partial Queue-An Unbounded Total Queue-An Unbounded Lock-Free Queue Memory Reclamation and the ABA Problem- Dual Data Structures- Concurrent Stacks and Elimination- An Unbounded Lock-Free Stack- Elimination-The Elimination Back off Stack.

Experiments

1. Implementation of graph search algorithms
2. Implementation of algorithms using the hill climbing and dynamic programming design techniques.
3. Implementation of recursive backtracking algorithms.
4. Implementation of randomized algorithms.
5. Implementation of various locking and synchronization mechanisms for concurrent linked lists, concurrent queues, and concurrent stacks.
6. Developing applications involving concurrency.

References

1. Jeff Edmonds, “How to Think about Algorithms”, Cambridge University Press, 2008.
2. M. Herlihy and N. Shavit, “The Art of Multiprocessor Programming”, Morgan Kaufmann, 2008.
3. Steven S. Skiena, “The Algorithm Design Manual”, Springer, 2008.
4. Peter Brass, “Advanced Data Structures”, Cambridge University Press, 2008.
5. S. Dasgupta, C. H. Papadimitriou, and U. V. Vazirani, “Algorithms” , McGrawHill, 2008.

PCSC004	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives

- Understand big data for business intelligence
- Learn business case studies for big data analytics
- Understand no-sql big data management
- Perform map-reduce analytics using Hadoop and related tools

Understanding Big Data

What is big data – why big data – convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine – advertising and big data – big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics

No-sql Data Management

Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schema less databases – materialized views – distribution models – sharing – master-slave replication – peer-peer replication – sharing and replication – consistency – relaxing consistency – version stamps – map-reduce – partitioning and combining – composing map-reduce calculations

Basics of Hadoop

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures

Map-reduce Applications

MapReduce workflows – unit tests with MR Unit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats

Hadoop Related Tools

Hbase – data model and implementations – Hbase clients – Hbase examples – praxis. Cassandra – Cassandra data model – Cassandra examples – Cassandra clients – Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing

Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

References

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
3. Tom White, "Hadoop: The Definitive Guide", 3rd Edition , O'Reilley, ,2012.
4. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
5. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.

PCSC005	COMPUTER NETWORKS MANAGEMENT	L	T	P	C
		3	0	1	4

Course Objectives

- To learn the network architecture and its services.
- To focus on the management of networks and its characteristics.
- To analyze the network performance with suitable parameters

Introduction to Network Management

Overview of Analysis, Architecture and Design Process-System Methodology, Service methodology, Service Description - Service characteristics - Performance Characteristics - Network supportability - Requirement analysis – User Requirements – Application Requirements – Device Requirements – Network Requirements – Other Requirements - Requirement specification and map.

Requirements Analysis

Requirement Analysis Process – Gathering and Listing Requirements- Developing service metrics – Characterizing behavior – Developing RMA requirements – Developing delay Requirements - Developing capacity Requirements - Developing supplemental performance Requirements – Requirements mapping – Developing the requirements specification

Flow Analysis

Individual and Composite Flows – Critical Flows - Identifying and developing flows – Data sources and sinks – Flow models- Flow prioritization – Flow specification algorithms – Example Applications of Flow Analysis

Network Architecture

Architecture and design – Component Architectures – Reference Architecture – Architecture Models – System and Network Architecture – Addressing and Routing Architecture – Addressing and Routing Fundamentals – Addressing Mechanisms – Addressing Strategies – Routing Strategies – Network Management Architecture – Network Management Mechanisms Performance Architecture – Performance Mechanisms – Security and Privacy Architecture – Planning security and privacy Mechanisms

Network Design

Design Concepts – Design Process - Network Layout – Design Traceability – Design Metrics – Logical Network Design – Topology Design – Bridging, Switching and Routing Protocols- Physical Network Design – Selecting Technologies and Devices for Campus and Enterprise Networks – Optimizing Network Design

Experiments

1. Analyzing the performance of various configurations and protocols in LAN
2. Simulation and performance comparison of RIP and OSPF Redistribution
3. Simulation of Dial-on-Demand Routing
4. Configuration Network Security protocols
5. Configuration and installation of fire wall

References

1. James D. McCabe and Morgan Kaufmann, “Network Analysis, Architecture, and Design “, 3rd Edition, McGraw Hill, 2007.
2. Larry L. Peterson and Bruce S. Davie,” Computer Networks: A Systems Approach”, ,Elsevier Inc. 2007.
3. Priscilla Oppenheimer, ”Top-down Network Design: A Systems Analysis Approach to Enterprise Network Design ”, Cisco Press , Third Edition,2009
4. Heinz-Gerd Hegering, Sebastian Abeck, and Bernhard Neumair “Integrated Management of Networked Systems: Concepts, Architectures, and Their Operational Application”, The Morgan Kaufmann Series in Networking, 1999.
5. Steven T.Karris ,“Network Design and Management”, 2nd edition, Orchard publications, 2009.

SEMESTER II

PCSC002	ADVANCED DATABASE TECHNOLOGY	L	T	P	C
		3	0	1	4

Course Objectives

- To learn the modelling and design of databases on parallel and distributed environment.
- To study the usage and applications of Object Oriented databases
- To understand the principles of intelligent databases and advanced data models.
- To learn emerging databases such as XML, Cloud and Big Data.

Parallel and Distributed Databases

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

Object and Object Relational Databases

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

Intelligent Databases

Active Databases: Syntax and Semantics (Starburst, Oracle, DB2)- Taxonomy-Applications Design Principles for Active Rules- Temporal Databases: Overview of Temporal DatabasesTSQL2- Deductive Databases: Logic of Query Languages – Datalog- Recursive Rules-Syntax and Semantics of Datalog Languages-Implementation of Rules and Recursion- Recursive Queries in SQL- Spatial Databases- Spatial Data Types- Spatial Relationships- Spatial Data Structures - Spatial Access Methods- Spatial DB Implementation.

Advanced Data Models

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

Emerging Technologies

XML Databases: XML-Related Technologies-XML Schema- XML Query Languages- Storing XML in Databases-XML and SQL- Native XML Databases- Web Databases- Geographic Information Systems- Biological Data Management- Cloud Based Databases: Data Storage Systems on the Cloud- Cloud Storage Architectures- Cloud Data Models- Query Languages- Introduction to Big Data-Storage-Analysis.

Experiments

- Implementation of distributed data bases
- Implementation of object oriented databases
- Implementation of parallel data base.
- Implementation of active database
- Implementation and analysis of deductive database
- Data Mining experiments using data mining tool like weka

References

1. R. Elmasri, and S.B. Navathe, "Fundamentals of Database Systems", 5th Edition, Pearson Education-Addison Wesley, 2007.
2. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", 3rd Edition, Pearson Education, 2007.
3. Henry F Korth, Abraham Silberschatz, and S. Sudharshan, "Database System Concepts", 5th Edition, McGraw Hill, 2006.
4. C.J.Date, A.Kannan and S.Swamynathan, "An Introduction to Database Systems", 8th Edition, Pearson Education, 2006.
5. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", McGraw Hill, 2004.

PCSC003	ADVANCED OPERATING SYSTEMS	L	T	P	C
		3	0	1	4

Course Objectives

- To learn the design principles of advanced Operating Systems
- To gain knowledge about Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols
- To know the components and management aspects of Real time, Mobile operating systems

Fundamentals of Operating Systems

Overview – Synchronization Mechanisms – Processes and Threads - Process Scheduling – Deadlocks: Detection, Prevention and Recovery – Models of Resources – Memory Management Techniques

Distributed Operating Systems

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

Distributed Resource Management

Distributed File Systems – Design Issues - Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory–Issues in Load Distributing – Scheduling Algorithms – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Non blocking Commit Protocol – Security and Protection.

Real Time and Mobile Operating Systems

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

Case Studies

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

Experiments

1. Development of a reasonably sized dynamically loadable kernel module for Linux kernel
2. Study educational operating systems such as Minix (http://www.minix3.org/), Weenix (http://weenix.cs.brown.edu/mediawiki/index.php/Weenix) and develop reasonably sized interesting modules for them
3. Study the Android open source operating system for mobile devices (http://source.android.com/) and develop / modify some modules.
4. Study any embedded and real-time operating system such as eCos (http://ecos.sourceware.org/) and develop / modify some modules.

References

1. Mukesh Singhal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 7th Edition, John Wiley & Sons, 2004.
3. Daniel P Bovet and Marco Cesati, "Understanding the Linux kernel", 3rd edition, O'Reilly, 2005.
4. Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education India, 2006.
5. Andrew S. Tanenbaum, "Modern Operating Systems", 3rd Edition, Pearson education, 2004.

PCSC006	FUZZY LOGIC AND NEURAL NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives

- To explore the nature of Artificial Neural Networks
- To learn the different perceptron models
- To understand fuzzy logic and its applications

Introduction

Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models - important technologies - applications. Fuzzy logic: Introduction - crisp sets- fuzzy sets - crisp relations and fuzzy relations: cartesian product of relation - classical relation, fuzzy relations, tolerance and quivalence relations, non-iterative fuzzy sets. Genetic algorithm- Introduction - biological background - traditional optimization and search techniques - Genetic basic concepts. Perception model and Back Propagation

Neural Networks

McCulloch-Pitts neuron - linear separability - hebb network - supervised learning network: perceptron networks - adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative auto associative memory network & iterative associative memory network – unsupervised learning networks: Kohonen self-organizing feature maps, LVQ – CP networks, ART network.

Fuzzy Logic

Membership functions: features, fuzzification, methods of membership value assignments Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals - fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.

Hybrid Techniques & Applications

Genetic algorithm and search space - general genetic algorithm – operators - Generational cycle - stopping condition – constraints - classification - genetic programming – multilevel optimization – real life problem- advances in GA - Neuro-fuzzy hybrid systems - genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems - simplified fuzzy ARTMAP - Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman

problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.

References

1. Laurene V. Fausett, “Fundamentals of Neural Networks-Architectures, Algorithms and Applications”, Pearson Education, 2011.
2. Timothy Ross, “Fuzzy Logic with Engineering Applications”, McGraw Hill, Singapore, 2010.
3. Zimmermann H J, “Fuzzy set theory and its Applications”, Allied Publishers Ltd, New Delhi, 2006.
4. James J.Buckley and Esfandiar Eslami,”Advances in Soft Computing-An Introduction to Fuzzy Logic and Fuzzy Sets”, Springer International Edition, New Delhi, 2011.
5. Simon Hakin, “ Neural Networks: A Comprehensive Foundation” ,Prentice Hall of India,2004

PCSC008	SOFTWARE QUALITY ASSURANCE AND TESTING	L	T	P	C
		3	0	0	3

Course Objectives

- Describe the various approaches to quality assurance in software development
- Understand the quality models in software development
- Evaluate the software system based on the chosen software quality model

Introduction

Introduction – Views on quality – Cost of quality - Quality models – Quality frameworks – Verification and Validation – Defect taxonomy – Defect management – Statistics and measurements – IEEE standards – Quality assurance and control processes

Verification

Introduction – Verification techniques – Inspections, reviews, walk-throughs – Case studies

Test Generation

Software testing- Validation – Test plan – Test cases - Test Generation – Equivalence partitioning – Boundary value analysis – Category partition method – Combinatorial generation - Decision tables – Examples and Case studies

Structural Testing

Introduction – Test adequacy criteria – Control flow graph – Coverages: block, conditions, multiple conditions, MC/DC, path – Data flow graph – Definition and use coverages – C-use, P-use, Defclear, Def-use – Finite state machines – Transition coverage – Fault based testing – Mutation analysis – Case studies

Functional Testing

Introduction – Test adequacy criteria - Test cases from use cases – Exploratory testing - Integration, system, acceptance, regression testing – Testing for specific attributes: Performance, load and stress testing – Usability testing – Security testing - Test automation – Test oracles

References

1. Boriz Beizer, "Software Testing Techniques", 2nd Edition, DreamTech, 2009.
2. Aditya P. Mathur, "Foundations of Software Testing", Pearson Education, 2008.
3. Mauro Pezze and Michal Young, "Software Testing and Analysis. Process, Principles, and Techniques", John Wiley 2008.
4. Stephen H. Kan, "Metrics and Models in Software Quality Engineering", 2nd Edition,

Pearson Education, 2003.
5. Kshirasagar Naik and Priyadarshi Tripathy, "Software Testing and Quality Assurance: Theory and Practice", John Wiley, 2008

SEMESTER III

PCSC007	MULTICORE ARCHITECTURES	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the recent trends in the field of Computer Architecture and identify performance related parameters
- To expose the students to the problems related to multiprocessing
- To understand the different types of multicore architectures
- To expose the students to warehouse-scale and embedded architectures

Fundamentals of Quantitative Design and Analysis

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

DLP in Vector, SIMD and GPU Architectures

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

TLP and Multiprocessors

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.

RLP and DLP in Warehouse-Scale Architectures

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

Architectures for Embedded Systems

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

References

1. George Coulouris, Jean Dollimore, Timkindberg, “Distributed Systems, Concepts and Design”, 4th edition, Pearson Education, 2009.
2. Ananth Grama, George Karypis, Vipin Kumar, Anshul Gupta, “Introduction to Parallel Computing”, 2nd edition, Pearson Education, 2003.
3. Andrew S. Tanenbaum and Maarten Van Steen, “Distributed Systems – Principles and Paradigms”, 2nd edition Prentice- Hall of India Pvt. Ltd, 2008.

4. M.L.Liu, “Distributed Computing Principles and Applications”, Pearson Addison Wesley, 2004.
5. Peter S. Pacheco, “An Introduction to Parallel Programming”, Morgan-Kauffman/Elsevier, 2011.

PROFESSIONAL ELECTIVES

PCSE001	ADVANCED COMPUTER ARCHITECTURE	L	T	P	C
		3	0	0	3

Course Objectives

- Learn the operation of modern and high performance computers
- Understand the performance comparison between modern high performance computers
- Learn to improve the performance of applications on multicore architectures

Instruction Level Parallelism

ILP–Concepts and challenges –Hardware and software approaches – Dynamic scheduling–Speculation–Compiler techniques for exposing ILP–Branch prediction. VLIW & EPIC-Superscalar – Advanced compiler support–Hardware support for exposing parallelism–Hardware versus software speculation mechanisms–IA 64 and Itanium processors–Limits on ILP.

Memory and I/O

Symmetric and distributed shared memory architectures–Performance issues –Synchronization–Introduction to Multithreading. Cache performance–Reducing cache miss penalty and miss rate–Reducing hit time–Main memory and performance–Memory technology. Types of storage devices–Buses–RAID– Reliability, availability and dependability–I/O performance measures–Designing an I/O System.

Multi-Threading

Software and hardware multithreading–SMT and CMP architectures–Design issues–Case studies– Intel Multi-core architecture –SUN CMP architecture–heterogeneous multi-core processors–case study: IBM Cell Processor.

References

1. David A. Patterson and John L. Hennessey, “Computer organization and design’, 5th edition, Morgan Kauffman, Elsevier, 2014.
2. Carl Hamacher V, Zvonko G. Varanesic and Safat G. Zaky, “Computer Organisation“,6th edition, Mc Graw-Hill, 2012.
3. Kai Hwang and Naresh Jotwani,”Advance Computer Architecture: Parallelism, Scalability, Programmability “, McGraw Hill,2015
4. Hwang,”Advanced Computer Architecture”, 2nd edition,TMH,2011
5. Richard Kain,”Advanced Computer Architecture: A Systems Approach”,Kindle Edition,2004

PCSE002	ADVANCED DATA MINING TECHNIQUES	L	T	P	C
		3	0	0	3

Course Objectives

- To develop skills of using recent data mining software for solving practical problems.
- To gain experience of doing research with Advanced Data mining techniques.

Introduction

Data mining tasks – mining frequent patterns, associations and correlations, classification and regression for predictive analysis, cluster analysis, outlier. Classification by backpropagation, support vector machines, classification using frequent patterns.

Cluster Analysis

Density – based methods – DBSCAN, OPTICS, DENCLUE; Grid – Based methods –STING, CLIQUE; Exception – maximization algorithm; clustering High –Dimensional Data; Clustering Graph and Network Data.

Association rule mining and Visualization

Introduction, web mining, web content mining, web structure mining, we usage mining, Text mining – unstructured text, episode rule discovery for texts, hierarchy of categories, text clustering. Introduction; Temporal Data Mining – Temporal Association Rules, Sequence Mining.

References

1. Chakrabarti, “Mining the Web: discovering knowledge from hypertext data”, Morgan Kaufmann 2003.
2. Pang Ning Tan, Steinbach and Vipin Kumar, “Introduction to data mining “, Data Flair edition,2011.
3. Olson, David L.Delen and Dursun,” Advanced Data Mining Techniques”, Springer, 2008.
4. Jiawei kan, Michaline Kamber and Jian Pei , “ Data Mining Concepts and Techniques”, Morgan Kaufmann ,2001.
5. Jie Tang,Irwin King, Ling Chen and Jianyong Wang,”Advanced Data Mining and Appplcations”,Springer,2011.

PCSE003	BIOMETRICS	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the biometric techniques for authentication
- To analyze the various recognition methods for authentication
- To analyze the various algorithms for preprocessing, segmentation and Classification

Introduction

Introduction–Benefits of biometric security–Verification and identification–Basic working of biometric matching–Accuracy. Finger scan–Features–Components–Operation (Steps)–Competing finger Scan technologies–Strength and weakness. Types of algorithms used for interpretation.

Physiological Biometrics

Iris Scan - Features–Components – Operation (Steps)–Competing iris Scan technologies–Strength and weakness. Voice Scan - Features – Components–Operation (Steps)–Competing voice Scan (facial) technologies–Strength and weakness -Other physiological biometrics–Hand scan–Retina scan–AFIS (Automatic Finger Print Identification Systems)

Behavioral Biometrics

Behavioral Biometrics–Signature scan- keystroke scan. Biometrics Application. Biometrics for Network Security-Statistical measures of Biometrics. Biometric Transactions

References

1. Samir Nanavati, Michael Thieme, Raj Nanavati,"Biometrics – Identity Verification in a Networked World", WILEY Dream Tech.
2. Paul Reid , "Biometrics for Network Security", Pearson Education, 2004
3. John D. Woodward., "Biometrics- The Ultimate Reference", Wiley Dreamtech.,2009
4. Khalid Saeed and Jerzy Pejas "Biometrics :"Computer Security Systems and Artificial Intelligence Applications" Springer,2010.
5. John Chirillo and Scott Blaul ,"Implementing Biometric Security" , Wiley Red Publications,2009

PCSE004	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the broad perceptive of cloud architecture and model
- To apply different cloud programming models as per requirement
- To be able to set up a private cloud.
- To understand the design of cloud Services.
- To learn to design the trusted cloud Computing system

Cloud Architecture and Model

Technologies for Network-Based System – System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture. Cloud Models:- Characteristics – Cloud Services – Cloud models (IaaS, PaaS, SaaS) – Public vs Private Cloud –Cloud Solutions - Cloud ecosystem – Service management – Computing on demand.

Virtualization

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

Cloud Infrastructure

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.

Programming Model

Parallel and Distributed Programming Paradigms – MapReduce , Twister and Iterative MapReduce – Hadoop Library from Apache – Mapping Applications - Programming Support - Google App Engine, Amazon AWS - Cloud Software Environments -Eucalyptus, Open Nebula, OpenStack, Aneka, CloudSim

Security in The Cloud

Security Overview – Cloud Security Challenges and Risks – Software-as-a-Service Security – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security - Identity Management and Access Control – Autonomic Security.

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. Kumar Saurabh, "Cloud Computing – insights into New-Era Infrastructure", Wiley India, 2011.
5. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud", O'Reilly ,2009.

PCSE005	COMPUTER VISION	L	T	P	C
		3	0	0	3

Course Objectives

- To provide knowledge about computer vision algorithms
- To understand the basic concepts of camera calibration, stereoscopic imaging and higher level image processing operations
- To familiarize the student with the image processing facilities in Matlab and its equivalent open source tools like OpenCV
- To appreciate the use of compute vision in Industrial applications and to understand the role of computer vision

Fundamentals of Vision

Image Formation and Representation, Intensity and Range Images – Camera models – Camera parameters – Camera models – Light and colour – Image Noise – Image Filtering (spatial domain) - Mask-based filtering - Image Smoothing, Sharpening.

Image Features

Image Features – Point and Line Detection – Hough Transform – Edge Detection – Corner Detection – Harris Detector – Textures - Deformable Contours – Features Reduction – Principal Component analysis – Feature Descriptors – SIFT and SURF.

Camera Calibration and Stereo Geometry

Camera Parameters – Intrinsic and Extrinsic parameters – Direct Parameter Calibration – Extraction from Projection matrix, Stereopsis – Correspondence Problem –RANSAC and Alignment - Epipolar Geometry

Motion Detection and Shape from Cues

Motion field of rigid objects – Notation of Optical flow – Estimating motion field – Estimation Motion Field – Horn and Schunck algorithm – Lucas and Kanade Algorithm – Using and Evaluation of Motion field – Shape from Shading and shape from Texture Model based Vision, smooth surfaces and their outlines, Aspect graphs and Range data.

High Level Vision

Interpretation trees, Invariants – Appearance and Shape based Classification – 3D object modeling – Matching from Intensity Data – Matching from Range Data – Visual Recognition – AdaBoost and Random Decision Forests.

References

1. Kurt Demaagd, Antony Oliver and Katherine Scott, “Practical Computer Vision’, Orelly, 1998.
2. Richard Szeliski,”Computer Vision: Algorithms and Applications”, Springer International, 2011.
3. David Forsyth and Jean Ponce ,”Computer Vision: A Modern Approach”, Prentice Hall, 2009.
4. Richard Hartley and Andrew Zisserman ,”Multiple View Geometry in Computer Vision”, Cambridge, 2001.
5. Reinhard Klette, “Concise Computer Vision: An Introduction into Theory and Algorithms”, Springer London, 2014.

PCSE006	CONCURRENCY MODELS	L	T	P	C
		3	0	0	3

Course Objectives

- To model concurrency in FSP
- To specify and check safety and liveness properties
- To understand concurrency architectures and design
- To apply linear temporal logic to safety and liveness analysis
- To apply Petri nets for concurrency modeling and analysis

Introduction

Concurrency and issues in concurrency – models of concurrency – graphical models – FSP & LTSA – modeling processes with FSP – concurrency models with FSP – shared action – structure diagrams – issues with shared objects – modeling mutual exclusion – conditional synchronization – modeling semaphores – nested monitors – monitor invariants

Deadlocks

Deadlocks – deadlock analysis in models – dining philosopher's problem – safety properties – single-lane bridge problem – liveness properties – liveness of the single- message passing – asynchronous message passing models – synchronous message passing Models-Supervisor-worker model – announcer-listener model – model-based design – from requirements to models – from models to implementations – implementing concurrency in Java – program verification

Petri nets

Introduction to Petri nets – examples – place-transition nets – graphical and linear algebraic representations – concurrency & conflict – coverability graphs – decision procedures – liveness – colored Petri nets (CPN) – modeling & verification using CPN – non-hierarchical CPN – modeling protocols – hierarchical CPN – timed CPN – applications of Petri

References

1. Jeff Magee & Jeff Kramer, "Concurrency: State Models and Java Programs", Second Edition, John Wiley, 2006.
2. M. Huth & M. Ryan, "Logic in Computer Science – Modeling and Reasoning about Systems", Second Edition, Cambridge University Press, 2004.
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4. Wolfgang Reisig, "Petri Nets: An Introduction", Springer, 2011.
5. K. Jensen and L. M. Kristensen, "Colored Petri Nets: Modeling and Validation of Concurrent Systems", Springer, 2009.
6. Wolfgang Reisig, "Understanding Petri Nets: Modeling Techniques, Analysis Methods, Case Studies", Springer, 2013.

PCSE007	DATA ANALYSIS AND BUSINESS SYNTHESIS	L	T	P	C
		3	0	0	3

Course Objectives

- To understand logistic regression models
- To understand generalized linear models
- To understand simulation using regression models
- To understand causal inference
- To understand multilevel regression, data collection and model understanding

Introduction to data analysis – Statistical processes – statistical models – statistical inference – review of random variables and probability distributions – linear regression – one predictor – multiple predictors – prediction and validation – linear transformations

Logistic regression – logistic regression coefficients – latent-data formulation – building a logistic regression model – logistic regression with interactions – evaluating, checking, and comparing fitted logistic regressions – identifiability and separation – Poisson regression

Simulation of probability models – summarizing linear regressions – simulation of non-linear predictions – predictive simulation for generalized linear models – fake-data simulation – Simulating and comparing to actual data – predictive simulation to check the fit of a time-series model – causal inference – randomized experiments – observational studies

Multilevel structures – clustered data – multilevel linear models – partial pooling – group-level predictors – model building and statistical significance – varying intercepts and slopes – scaled inverse - Design of data collection – classical power calculations – multilevel power calculations – power calculation using fake-data simulation – understanding and summarizing fitted models – uncertainty and variability

References

1. Andrew Gelman and Jennifer Hill, "Data Analysis using Regression and multilevel/Hierarchical Models", Cambridge University Press, 2006.
2. Philipp K. Janert, "Data Analysis with Open Source Tools", O'Reilley, 2010.
3. Wes McKinney, "Python for Data Analysis", O'Reilley, 2012.
4. Davinderjit Sivia and John Skilling, "Data Analysis: A Bayesian Tutorial", Second Edition, Oxford University Press, 2006.
5. Robert Nisbelt, John Elder, and Gary Miner, "Handbook of statistical analysis and Datamining applications", Academic Press, 2009.

PCSE008	DATA VISUALISATION TECHNIQUES	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the importance of data visualization.
- To know the different types of visualization techniques.
- To create various types of visualizations to gain insight into process or data

Introduction

Introduction – Issues – Data Representation – Data Presentation – Common Mistakes in design.

Foundations for Data Visualization

Visualization stages – Experimental Semiotics based on Perception Gibsons Affordance theory - A Model of Perceptual Processing – power of visual Perception-Types of Data-visualization and data objects.

Computer Visualization

Non-Computer Visualization – Computer Visualization: Exploring Complex Information Spaces – Fisheye Views – Applications – Comprehensible Fisheye views – Fisheye views for 3D data – Interacting with visualization

Multidimensional Visualization

One Dimension – Two Dimensions – Three Dimensions – Multiple Dimensions – Trees – Web Works – Data Mapping: Document Visualization – Workspaces.

Case Studies

Small interactive calendars – Selecting one from many – Web browsing through a key hole – Communication analysis – Archival analysis

References

1. Colin Ware, “Information Visualization Perception for Design” 2nd edition., Margon Kaufmann Publishers, 2004,
2. Robert Spence “Information visualization – Design for interaction”, 2 nd Edition, Pearson Education, 2007
3. Stephen Few, “Information Dashboard Design-The Effective Visual Communication of Data”,1st Edition, O'Reilly Media Publisher, 2006
4. Stuart.K.Card, Jock.D.Mackinlay and Ben Shneiderman, “Readings in Information Visualization Using Vision to think”, Morgan Kaufmann Publishers.
5. Nathn yau,”Visualize this: The flowing Data Guide to Design, Visualization, and statistics”, Wiley Publishers,2009.

PCSE009	DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the basics of Digital Images.
- To learn basic image analysis – Segmentation, edge detection and corner detection
- To learn Morphological operations and texture analysis
- To understand processing of color images and image compression techniques

Introduction

Elements of digital image process system – Imagining and Acquisition-Image sampling and quantization – Basic relationship between Pixels – Spatial domain methods – Frequency domain methods – Histogram modification techniques Neighborhood averaging – median filtering - Low pass filtering.

Image Filtering

Image observation models – restoration in the presence of noise only spatial filtering: mean filters, order statistics filters, adaptive filters – Inverse filtering – Wiener filtering. Edge detection: Gradient operators edge linking and boundary detection: GlobalprocessingviaHoughtransformsGraphtheoretictechniques-Thresholding: Global thresholding.

Segmentation

JPEG – MPEG - Quantization: scalar Quantization and vector Quantization –code word assignment: uniform length and variable length code word assignment –differential pulse code modulation, two channel coders, pyramid coding; hybrid transform coding – wavelet coding - Application.

References

1. Rafael C, Gonzalez,Richard E, Woods, Steven L and Eddins,“Digital Image Processing Using MATLAB”, Third Edition, Tata McGraw Hill Pvt. Ltd., 2011.
2. Anil Jain K.“Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.
3. Malay K. Pacher, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt .Ltd., 2011.
4. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition Pearson Education, 2010.
5. Anil K. Jain,” Digital Image Processing: Introduction and Overview”, PHI Learning Pvt. Ltd., 1999.

PCSE010	ENERGY AWARE COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives

- To know the fundamental principles of energy efficient devices
- To study the concepts of Energy efficient storage
- To introduce energy efficient algorithms
- To enable the students to know energy efficient techniques involved to support real-time systems.

Introduction

Energy efficient network on chip architecture for multi core system - Energy efficient MIPS CPU core with fine grained run time power gating – Low power design of emerging memory technologies. Disk Energy Management-Power efficient strategies for storage system-Dynamic thermal management for high performance storage systems-Energy saving technique for Disk storage systems.

Algorithms

Scheduling of Parallel Tasks – Task level Dynamic voltage scaling – Speed Scaling – Processor optimization- Memetic Algorithms – Online job scheduling Algorithms. Multi-processor system – Real Time tasks- Energy Minimization – Energy aware scheduling- Dynamic Reconfiguration- Adaptive power management - Energy Harvesting Embedded system.

Applications

On chip network – Video codec Design – Surveillance camera- Low power mobile storage.

References

1. Ishfaq Ahmad and Sanjay Ranka, “Handbook of Energy Aware and Green Computing”, Chapman and Hall - CRC, 2012
2. Chong-Min Kyung and Sungioo yoo, “Energy Aware system design Algorithms and Architecture”, Springer, 2011.
3. Bob steigerwald and Chris Lucero, “Energy Aware computing: Powerful approaches for Green System Design””, Intel Press, 2012.
4. Robert Graybill,”Power Aware Computing” Springer,2014.
5. Martin Wlotzka,Vincent Heuveline, Manuel F.Dolz,“Energy Aware High Performance Computing”,O’Reilly,2012.

PCSE011	GRAPH THEORY	L	T	P	C
		3	0	0	3

Course Objectives

- Be familiar with the most fundamental Graph Theory topics and results.
- Be exposed to the techniques of proofs and analysis.

Introduction

Graphs – Introduction – Isomorphism – Sub graphs – Walks, Paths, Circuits –Connectedness – Components – Euler graphs – Hamiltonian paths and circuits – Trees – Properties of trees – Distance and centers in tree – Rooted and binary trees.

Trees, Connectivity & Planarity

Spanning trees – Fundamental circuits – Spanning trees in a weighted graph – cut sets – Properties of cut set – All cut sets – Fundamental circuits and cut sets – Connectivity and separability – Network flows – 1-Isomorphism – 2-Isomorphism – Combinational and geometric graphs – Planer graphs – Different representation of a planer graph.

Matrices, Colouring and Directed Graph

Chromatic number – Chromatic partitioning – Chromatic polynomial – Matching – Covering – Four color problem – Directed graphs – Types of directed graphs – Digraphs and binary relations – Directed paths and connectedness – Euler graphs.

Permutations & Combinations

Fundamental principles of counting - Permutations and combinations - Binomial theorem - combinations with repetition - Combinatorial numbers - Principle of inclusion and exclusion - Derangements - Arrangements with forbidden positions.

Generating Functions

Generating functions - Partitions of integers - Exponential generating function – Summation operator - Recurrence relations - First order and second order – Non-homogeneous recurrence relations - Method of generating functions.

References

1. Narsingh Deo, “Graph Theory: With Application to Engineering and Computer Science”, Prentice Hall of India, 2003.
2. Grimaldi R.P. “Discrete and Combinatorial Mathematics: An Applied Introduction”, Addison Wesley, 1994.
3. Clark J. and Holton D.A, “A First Look at Graph Theory”, Allied Publishers, 1995.
4. Mott J.L., Kandel A. and Baker T.P. “Discrete Mathematics for Computer Scientists and Mathematicians”, Prentice Hall of India, 1996.
5. Liu C.L., “Elements of Discrete Mathematics”, Mc Graw Hill, 1985.

PCSE012	INFORMATION RETRIEVAL TECHNIQUES	L	T	P	C
		3	0	0	3

Course 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

Introduction

Motivation – 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

Modeling

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

Indexing

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.

Classification and Clustering

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

Searching and Ranking

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

References

1. Ricardo Baeza Yates and Berthier Ribeiro Neto, “Modern Information Retrieval: The concepts and Technology behind Search “Second Edition ,ACM Press Books, 2011
2. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schutze,”Introduction to Information

Retrieval", First South Asian Edition ,Cambridge University Press, 2012
3. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, "Information Retrieval Implementing and Evaluating Search Engines", The MIT Press, Cambridge, Massachusetts London, England, 2010.
4. Chawduhry G G," Introduction to Modern Information Retrieval", Facet Publishers,2010.
5. Stephen Butcher and Charles .Clarke L.A,"Information Retrieval : Implementing and Evaluating Search Engines", MIT Press,2010.

PCSE013	INFORMATION STORAGE MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives

- To provide a strong understanding of information storage technologies.
- To enable them to make more informed decisions on installing IT infrastructure.
- To enable them to adapt to the complexities of modern storage technologies.

Introduction to Storage Technology

Review data creation and the amount of data being created and understand the value of data to a business, challenges in data storage and data management, Solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities

Storage Systems Architecture

Hardware and software components of the host environment, Key protocols and concepts, Physical and logical components of a connectivity environment , Physical components of a disk drive and their function, logical constructs of a physical disk, access characteristics, and performance Implications, Concept of RAID and its components, Different RAID levels and their suitability for different application environments - Integrated and modular storage systems ,high-level architecture - working of an intelligent storage system

Introduction to Networked Storage

Evolution of networked storage, Architecture, components, and topologies of FC-SAN, NAS, and IP-SAN, Benefits of the different networked storage options, understand the need for long-term archiving solutions and describe how CAS full fill the need, understand the appropriateness of the different networked storage options for different application environments

Information Availability, Monitoring & Managing Datacenter

Planned/unplanned outages - Impact of downtime - Business continuity (BC) and disaster recovery (DR) ,RTO and RPO, Single points of failure - solutions to mitigate these failures, Architecture of backup/recovery and the different backup/ recovery topologies, replication technologies, Remote replication technologies - Monitoring a data center, Industry standards for data center monitoring and management, Key metrics to monitor storage infrastructure, Key management tasks in a data center

Securing Storage and Storage Virtualization

Information security, Critical security attributes for information systems, Storage security domains, List and analyzes the common threats in each domain, Virtualization technologies, block-level and file-level virtualization technologies and processes

References

1. EMC Corporation, “Information Storage and Management”, Wiley, India , 2012.
2. Robert Spalding, “Storage Networks: The Complete Reference “, Tata McGraw Hill, Osborne,

2003.
3. Marc Farley, “Building Storage Networks”, Tata McGraw Hill, Osborne, 2001.
4. Additional resource material on www.emc.com/resource-library/resource-library.esp
5. Vaishali D. Kaimer and Nilima M.Dongre , “Storage Network management and Retrieval”,Wiley,2015.

PCSE014	MEDICAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

Course Objectives

- To be aware of the latest trends in medical image processing and medical image analysis
- To extract, model and analyze information from medical data
- To help diagnosis, treatment and monitoring of diseases through computer science

Introduction

Introduction to medical imaging technology, systems, and modalities. Brief history; importance; applications; trends; challenges. Medical Image Formation Principles: X-Ray physics; X-Ray generation, attenuation, scattering; dose Basic principles of CT; reconstruction methods; artifacts; CT hardware.

Storage and Processing

Medical Image Storage, Archiving and Communication Systems and Formats Picture archiving and communication system (PACS); Formats: DICOM Radiology Information Systems (RIS) and Hospital Information Systems (HIS). Medical Image Processing, Enhancement, Filtering Basic image processing algorithms Thresholding; contrast enhancement; SNR characteristics; filtering; histogram modeling.

Visualization

Medical Image Visualization Fundamentals of visualization; surface and volume rendering/visualization; animation; interaction. Magnetic Resonance Imaging (MRI) Mathematics of MR; spin physics; NMR spectroscopy; imaging principles and hardware; image artifacts.

Segmentation and Classification

Medical Image Segmentation - Histogram-based methods; Region growing and watersheds; Markov Random Field models; active contours; model-based segmentation. Multi-scale segmentation; semi-automated methods; clustering-based methods; classification-based methods; atlas-guided approaches; multi-model segmentation. Medical Image Registration Intensity-based methods; cost functions; optimization techniques.

Nuclear Imaging

PET and SPECT Ultrasound Imaging methods; mathematical principles; resolution; noise effect; 3D imaging; positron emission tomography; single photon emission tomography; ultrasound imaging; applications. Medical Image Search and Retrieval Current technology in medical image search, content-based image retrieval, new trends: ontologies. Applications. Other Applications of Medical Imaging Validation, Image Guided Surgery, Image Guided Therapy, Computer Aided Diagnosis/Diagnostic Support Systems.

References

1. Paul Suetens, "Fundamentals of Medical Imaging", Second Edition, Cambridge University Press, 2009.
2. J. Michael Fitzpatrick and Milan Sonka, "Handbook of Medical Imaging: Medical Image Processing and Analysis", SPIE Publications, 2009.
3. Kayvan Najarian and Robert Splinter, "Biomedical Signal and Image Processing", Second Edition, CRC Press, 2005.
4. Geoff Dougherty, "Digital Image Processing for Medical Applications", First Edition, Cambridge University Press, 2009.
5. Jerry L. Prince and Jonathan Links, "Medical Imaging Signals and Systems", First Edition, Prentice Hall, 2005.

PCSE015	MOBILE ADHOC NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives

- To be aware characteristics and features of mobile Adhoc networks
- To understand the protocols used in Mobile Adhoc networks
- To learn the security challenges, requirements of mobile Adhoc networks
- To learn the cross layer design and integration of mobile Adhoc network with 4G networking technologies

Introduction

Introduction to Adhoc networks – definition, characteristics features, applications. Characteristics of Wireless channel, Adhoc Mobility Models: - Indoor and outdoor models.

Medium Access Protocols

MAC Protocols: design issues, goals and classification. Contention based protocols- with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

Network Protocols

Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, Energy aware routing algorithm, Hierarchical Routing, QoS aware routing.

End-End Delivery and Security

Transport layer : Issues in desiging- Transport layer classification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols.

Cross Layer Design And Integration of Adhoc For 4g

Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, Cross layer cautionary prespective. Intergration of adhoc with Mobile IP networks.

References

1. C.Siva Ram Murthy and B.S.Manoj, “Ad hoc Wireless Networks Architectures and protocols”,2nd edition, Pearson Education. 2007
2. Charles E. Perkins, “Ad hoc Networking”, Addison – Wesley, 2000
3. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, “Mobile ad hoc networking”, Wiley-IEEE press, 2004.
4. Mohammad Ilyas, “The handbook of Adhoc wireless networks”, CRC press, 2002.

5. T. Camp, J. Boleng, and V. Davies “A Survey of Mobility Models for Ad Hoc Network”, Springer,2004.

PCSE016	MOBILE AND PERVASIVE COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the basics of Mobile Computing and Personal Computing
- To learn the role of cellular networks in Mobile and Pervasive Computing
- To expose to the concept of sensor and mesh networks
- To expose to the context aware and wearable computing
- To learn to develop applications in mobile and pervasive computing environment

Introduction

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

3G and 4G Cellular Networks

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

Sensor and Mesh Networks

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

Context Aware Computing & Wearable Computing

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 Health BAN-Medical and Technological Requirements-Wearable Sensors

Application Development

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

References

1. Jochen Burkhardt, Horst Henn, Stefan Hepper and Thomas Schaec Klaus Rind torff," Pervasive computing Technology and Architecture of Mobile Internet Applications", Addison Wesley, New Delhi, 2009.
2. Frank Adelstein, Sandeep KS Gupta , Golden G Richard III and Loren Schwiebert, "Fundamentals of Mobile and Pervasive Computing", Tata McGraw-Hill Publishing Company, New Delhi, 2005.
3. Uw eHansmann, L. Merk, Nicklous M., Stober T., Hansmann U., "Pervasive Computing (Springer Professional Computing)", 2003, Springer Verlag,2005.
4. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, "Mobile Computing: Technology, Applications and Service Creation", 2nd ed, Tata McGraw Hill, 2010.
5. Gannon Curran," Context Aware Systems and Applications", Springer,2015.

PCSE017	NETWORK AND INFORMATION SECURITY	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the fundamentals of Cryptography
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.

Introduction

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

Cryptosystems & Authentication

Classical Cryptography-Substitution Ciphers-permutation Ciphers-Block Ciphers-DES- Modes of Operation- AES-Linear Cryptanalysis, Differential Cryptanalysis- Hash Function - SHA 512-Message Authentication Codes-HMAC - Authentication Protocols

Public Key Cryptosystems

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

System Implementation

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

Network Security

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

References

1. William Stallings, “Cryptography and Network Security: Principles and Practices”, Third Edition, Pearson Education, 2006.
2. Matt Bishop ,“Computer Security art and science ”, Second Edition, Pearson Education, 2002
3. Wade Trappe and Lawrence C. Washington, “Introduction to Cryptography with Coding Theory” Second Edition, Pearson Education, 2007
4. Jonathan Katz, and Yehuda Lindell, Introduction to Modern Cryptography, CRC Press, 2007
5. Douglas R. Stinson, “Cryptography Theory and Practice”, Third Edition, Chapman & Hall-CRC, 2006.

PCSE018	PATTERN RECOGNITION	L	T	P	C
		3	0	0	3

Course Objectives

- Understand the knowledge of learning and adaptation in supervised modes of learning
- To know the knowledge of recognition, decision making and statistical learning problems.
- Provide knowledge of current research topics and issues in Pattern Recognition and Machine Learning
- Provide experience in conducting and presenting a literature review on a research topic.

Baye's Decision Theory

Discriminant Functions and Services -the Normal Distribution-Bayesian Classification -Estimating Probability Density Functions -Nearest Neighbor Rules -Bayesian Networks

Linear Classifiers

Perceptron Algorithm -Least-Squares Methods -Nonlinear Classifiers -Multilayer Perceptron's -Back Propagation Algorithm Pattern Recognition -Decision Trees -Combinations of Classifiers -Boosting

Feature Selection

Data Preprocessing -ROC Curves -Class Separability Measures -Feature Subset Selection -Bayesian Information Criterion -Dimensionality Reduction -Basis Vectors -Singular Value Decomposition -Independent Component Analysis -Kernel PCA –Wavelets.

References

1. Bishop C. M., "Pattern Recognition and Machine Learning", Springer, 2007.
2. Barber 5. D., "Bayesian Reasoning and Machine Learning", Cambridge University Press, 2012.
3. Theodoridis, S. and Koutroumbas, K. "Pattern Recognition",4th Edition . Academic Press, 2008.
4. Duda, R.O., Hart, P.E., and Stork, D.G. "Pattern Classification", 2nd Edition, Wiley-Interscience. 2001.
5. Christopher Bishop," Pattern recognition and Machine Learning" Springer, 2005.

PCSE019	RESOURCE MANAGEMENT TECHNIQUES	L	T	P	C
		3	0	0	3

Course Objectives

- Be familiar with resource management techniques.
- Learn to solve problems in linear programming and Integer programming.
- Be exposed to CPM and PERT.

Linear Programming

Principal components of decision problem – Modeling phases – LP Formulation and graphic solution – Resource allocation problems – Simplex method – Sensitivity analysis.

Duality and Networks

Definition of dual problem – Primal – Dual relationships – Dual simplex methods – Post optimality analysis – Transportation and assignment model - Shortest route problem.

Integer Programming

Cutting plan algorithm – Branch and bound methods, Multistage (Dynamic) programming.

Classical Optimization Theory

Unconstrained external problems, Newton – Ralphson method – Equality constraints – Jacobean methods – Lagrangian method – Kuhn – Tucker conditions – Simple problems.

Object Scheduling

Network diagram representation – Critical path method – Time charts and resource leveling – PERT.

References

1. H.A. Taha, "Operation Research", Prentice Hall of India, 2002.
2. Paneer Selvam, „Operations Research", Prentice Hall of India, 2002
3. Anderson „Quantitative Methods for Business", 8th Edition, Thomson Learning, 2002.
4. Winston „Operation Research", Thomson Learning, 2003.
5. Vohra, „Quantitative Techniques in Management", Tata Mc Graw Hill, 2002.

PCSE020	SOFTWARE PROCESS AND PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives

- To understand overall SDLC and adopt suitable processes
- To analyze, prioritize, and manage both functional and quality requirements
- To estimate efforts required, plan, and track the plans
- To understand and apply configuration and quality management techniques
- To evaluate, manage, and design software processes

Development Life Cycle Processes

Overview of software development life cycle – introduction to processes – Personal Software Process (PSP) – Team software process (TSP) – Unified processes – agile processes – choosing the right process Tutorial: Software development using PSP

Requirements Management

Functional requirements and quality attributes – elicitation techniques – Quality Attribute Workshops (QAW) – analysis, prioritization, and trade-off – Architecture Centric Development Method (ACDM) – requirements documentation and specification – change management – traceability of requirements Tutorial: Conduct QAW, elicit, analyze, prioritize, and document requirements using ACDM

Estimation, Planning, and Tracking

Identifying and prioritizing risks – risk mitigation plans – estimation techniques – use case points – function points – COCOMO II – top-down estimation – bottom-up estimation – work breakdown structure – macro and micro plans – planning poker – wideband delphi – documenting the plan – tracking the plan – earned value method (EVM) Tutorial: Estimation, planning, and tracking exercises

Configuration and Quality Management

Identifying artifacts to be configured – naming conventions and version control – configuration control – quality assurance techniques – peer reviews – Fegan inspection – unit, integration, system, and acceptance testing – test data and test cases – bug tracking – causal analysis Tutorial: version control exercises, development of test cases, causal analysis of defects

Software Process Definition and Management

Process elements – process architecture – relationship between elements – process modeling – process definition techniques – ETVX (entry-task-validation-exit) – process baselining – process assessment and improvement – CMMI – Six Sigma Tutorial: process measurement exercises, process definition using ETVX TOTAL 45+15=60 PERIODS

References

1. Pankaj Jalote, “Software Project Management in Practice”, Pearson, 2002.
2. Chris F. Kemerer, “Software Project Management – Readings and Cases”, McGraw Hill, 1997.
3. Watts S. Humphrey, “PSP: A self-improvement process for software engineers”, Addison Wesley, 2005.
4. Watts S. Humphrey, “Introduction to the Team Software Process”, Addison-Wesley, 2000.
5. Orit Hazzan and Yael Dubinsky, “Agile software engineering”, Springer, 2008.

PCSE021	SOFTWARE REQUIREMENTS ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

- Understand system requirements
- Identify different types of requirement
- Generate requirements be elicitation
- Develop requirements documentation
- Evaluate the requirements

Domain Understanding

Introduction – Types of requirements – Requirements engineering process – Validating requirements – Requirements and design – Requirements and test cases – introduction to business domain – Problem analysis – Fish bone diagram – Business requirements – Business process modelling – Business use cases – Business modelling notations – UML Activity diagrams.

Requirements Elicitation

Understanding stakeholders' needs – Elicitation techniques – interviews, questionnaire, workshop, brainstorming, prototyping – Documenting stakeholders' needs.

Functional Requirements

Introduction – Features and Use cases – Use case scenarios – Documenting use cases – Level of details – SRS documents.

Quality Attributes and User Experience

Quality of solution – Quality attributes – Eliciting quality attributes – Quality attribute workshop (QAW) – Documenting quality attributes – Six part scenarios – Usability requirements – Eliciting and documenting usability requirements – Modelling user experience – Specifying UI design

Managing Requirements

Defining scope of the project – Context diagram – Managing requirements – Requirements properties – Traceability – Managing changes – Requirements metrics – Requirements management tools.

References

1. Axel van Lamsweerde, "Requirements Engineering", Wiley, 2009
2. Gerald Kotonya, Ian Sommerville, "Requirements Engineering: Processes and Techniques", John Wiley and Sons, 1998
3. Dean Leffingwell and Don Widrig, “Managing Software Requirements: A Use Case Approach ,2nd Edition ”, Addison-wesley, 2003

4. J Nielsen, “Usability Engineering”, Academic Press, 1993.
5. Karl Weigers, “Software Requirements 2”,2nd Edition, Jenson Publishers,2002.

PCSE022	SPEECH PROCESSING AND SYNTHESIS	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the mathematical foundations needed for speech processing, concepts and algorithms of speech processing and synthesis
- To familiarize the students with the various speech signal representation, coding and Recognition techniques
- To appreciate the use of speech processing in current technologies and to expose the students to real– world applications of speech processing

Introduction – Spoken Language Structure – Phonetics and Phonology – Syllables and Words – Syntax and Semantics –Probability Theory – Estimation Theory – Information Theory.

Overview of Digital Signal Processing – Speech Signal Representations – Short time Fourier Analysis – Acoustic Model of Speech Production – Linear Predictive Coding – Cepstral Processing– Formant Frequencies – The Role of Pitch – Speech Coding – LPC Coder.

Hidden Markov Models – Definition – Continuous and Discontinuous HMMs – Practical Issues – Limitations. Acoustic Modeling – Variability in the Speech Signal – Extracting Features – Phonetic Modeling – Adaptive Techniques – Confidence Measures

Morphological Analysis – Letter-to-sound Conversion – Prosody – Generation schematic – Speaking Style – Symbolic Prosody – Duration Assignment – Pitch Generation Attributes – Formant Speech Synthesis – Concatenative Speech Synthesis – Prosodic Modification of Speech – Source-filter Models for Prosody Modification – Evaluation of TTS Systems.

References

1. Xuedong Huang, Alex Acero, Hsiao-Wuen Hon, “Spoken Language Processing – A guide to Theory, Algorithm and System Development”, Prentice Hall PTR, 2001.
2. Thomas F.Quatieri, “Discrete-Time Speech Signal Processing”, Pearson Education, 2002.
3. Sadaoki Furui, “Digital Speech Processing: Synthesis, and Recognition, Second Edition,
4. Marcel Dekker ,Signal Processing and Communications”, Springer , 2000.
5. Joseph Mariani, “Language and Speech Processing”, Wiley, 2009.

PCSE023	WIRELESS SENSOR NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives

- To learn the technical, economic and service advantages of next generation networks.
- To learn the basic architecture of a next generation network (NGN) with reference.
- To learn the role of Multimedia Sub-System, network attachment and admission control functions.
- To learn and compare the various methods of providing connection-oriented services

Introduction

Background of Sensor Network Technology, Application of Sensor Networks, Challenges for Wireless Sensor Networks, Mobile Adhoc Networks (MANETs) and Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks

Architecture

Single-node Architecture, Hardware Components & Design Constraints, Operating Systems and Execution Environments, Introduction to TinyOS and nesC, Network Architecture, Sensor Network Scenarios, Optimization Goals and Figures of Merit, Design Principles for WSNs, Service Interfaces of WSNs, Gateway Concepts.

Routing

Localization and Positioning, Coverage and Connectivity, Single-hop and Multi-hop Localization, Self-Configuring Localization Systems. Issues in Designing Routing Protocols, Classification of Routing Protocols, Energy-Efficient Routing, Unicast, Broadcast and Multicast, Geographic Routing. Data Centric and Content based Routing, Storage and Retrieval in Network, Compression Technologies for WSN, Data Aggregation Technique. Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level Software Platforms, Node-level Simulators, State-centric Programming.

References

1. Holger Karl & Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
3. Raghavendra , Cauligi S, Sivalingam, Krishna M., and Zanti Taieb, “Wireless Sensor Network”, Springer , 2004 .
4. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks- Technology, Protocols, and Applications”, John Wiley, 2007.
5. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003.

GENERIC ELECTIVES

PPSG001	ROBOTICS	L	T	P	C
		3	0	0	3

Course Objectives

- To understand robot locomotion and mobile robot kinematics
- To understand perception in robotics
- To understand mobile robot localization
- To understand mobile robot mapping
- To understand simultaneous localization and mapping (SLAM)
- To understand robot planning and navigation

Locomotion and Kinematics

Introduction to Robotics – key issues in robot locomotion – legged robots – wheeled mobile robots – aerial mobile robots – introduction to kinematics – kinematics models and constraints – robot manoeuvrability

Robot Perception

Sensors for mobile robots – vision for robotics – cameras – image formation – structure from stereo – structure from motion – optical flow – color tracking – place recognition – range data

Mobile Robot Localization

Introduction to localization – challenges in localization – localization and navigation – belief representation – map representation – probabilistic map-based localization – Markov localization – EKF localization – UKF localization – Grid localization – Monte Carlo localization – localization in dynamic environments

Mobile Robot Mapping

Autonomous map building – occupancy grip mapping – MAP occupancy mapping – SLAM – extended Kalman Filter SLAM – graph-based SLAM – particle filter SLAM – sparse extended information filter – fastSLAM algorithm

Planning and Navigation

Introduction to planning and navigation – planning and reacting – path planning – obstacle avoidance techniques – navigation architectures – basic exploration algorithms

References

1. Roland Seigwart, Illah Reza Nourbakhsh, and Davide Scaramuzza, “Introduction to autonomous mobile robots”, Second Edition, MIT Press, 2011.
2. Sebastian Thrun, Wolfram Burgard, and Dieter Fox, “Probabilistic Robotics”, MIT Press, 2005.
3. Howie Choset et al., “Principles of Robot Motion: Theory, Algorithms, and Implementations”, A Bradford Book, 2005.
4. Gregory Dudek and Michael Jenkin, “Computational Principles of Mobile Robotics”, Second Edition, Cambridge University Press, 2010.
5. Maja J. Mataric, “The Robotics Primer”, MIT Press, 2007.

PCOG002	APPLICATIONS OF MEMS TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives

- To impart the basic knowledge about the Microsystems, Smart materials and systems.
- To inculcate the knowledge about the sensors and actuators.
- To understand the various fabrication process techniques for MEMS structures.

Introduction to MEMS; scaling issues, Smart materials, smart systems, sensors and actuators, MEMS sensors in biomedical applications.

Structure of silicon and other materials, properties: Young modulus, Poisson's ratio, density, piezoresistive coefficients, TCR, Thermal Conductivity, Material Structure. Understanding Selection of materials based on applications. Silicon wafer processing; Thin-film deposition, Lithography, wet etching and dry etching, Bulk micromachining and Surface micromachining, Wafer-bonding; LIGA and other moulding techniques, Soft lithography and polymer processing, Thick-film processing; Low temperature co-fired ceramic processing, Smart material processing.

MEMS devices: Architecture, working and basic quantitative behaviour of Cantilevers, Microheaters, Accelerometers, Pressure Sensors, Micro mirrors

References

1. Tai-Ran Hsu, "MEMS and Microsystems: Design, Manufacture, and Nanoscale Engineering", John Wiley & Sons, 2008.
2. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat, and V. K. Aatre, "Micro and Smart Systems", Wiley-India, 2010.
3. Marc Madou, "Fundamentals of Micro fabrication: The Science of Miniaturization", CRC Press, Second Edition, 2002.
4. NadimMaluf," An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
5. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2000

PMGG003	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		3	0	0	3

Course Objectives

To acquire knowledge of learn about the intellectual property rights. To learn the procedure for registering Patents, Copy Rights, Trademarks and Geographical Indication. To protect one‘s intellectual property rights.

Introduction to IPR, International cooperation on IPR, Major Treaties, International convention relating to Intellectual Property – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT).

Nature & Importance of Patents, Copy Rights, Trade Marks, Geographical Indication. Procedure to file Application for grant of Patents, Copy rights, Trade Marks and Geographic Indication. Emerging trends in IPR, IPR litigation, Case Studies on Patents, Copyright and related rights, Trade Marks, geographic indications

References

1. Bare Acts (Up-to-date)
2. Subbaram N. R., and Viswanathan S., ―Handbook of Indian Patent Law and Practice‖, Printers and Publishers Pvt. Ltd., 2008.
3. Susan K. Sell, ―Private Power, Public Law: The globalization of Intellectual Property Rights‖, Cambridge studies in International relations, Cambridge University Press, 2013.
4. Wadehra, B.L., ―Law relating to Intellectual Property‖, University law publishing company Private Ltd, 4th Edition, 2010.
5. Bhandari, M.K., ―Law Relating to Intellectual Property Rights‖, Central Law Publications, 4th Edition, 2015.