Nirma University

Institute of Technology

School of Technology

Department of Computer Science and Engineering

M Tech in Network Technology

3CS3104

Advance Computing Systems **[3 0 1 4]**

Course Learning Outcome:

After successful completion of the course, student will be able to

- realize the fundamentals of parallel scientific computing
- understand various parallel architectures and programming models
- understand various issues like load balancing, communication, and synchronization overhead for HPC systems
- compare the techniques/methods for energy aware computing

Syllabus:

Requirements and General Issues of High performance computing,
Overview of Parallel Processing Concepts, Levels of parallelism (instruction, transaction, task, thread, memory, function), Models(SIMD, MIMD, SIMT, SPMD, Dataflow Models, Demand-driven Computation etc),
Architectures: N-wide superscalar architectures, multi-core, multi-threaded
Scheduling Parallel jobs on HPC systems, Run time parallelization, Job and Resource Management Systems Constructing Scalable Services, Performance Models and Simulations, Meta-Computing: Harnessing Informal Supercomputers, Specifying Resources and Services in Meta-Computing Systems
Load Balancing over High Speed Networks, Network RAM, Distributed Shared Memory
Programming languages extensions for HPC, Execution profiling, timing techniques, and benchmarking for modern single-core and multi-core processors
Power-Aware Computing and Communication: Power-aware Processing Techniques, Power-aware Memory Design, Power-aware Interconnect Design, Software Power Management
Advanced Topics: Petascale Computing, Optics in Parallel Computing, Quantum Computers, Recent developments in the area of High Performance Architectures and its impact on HPC

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 5 experiments to be incorporated.

References:

1. RajkumarBuyya, High Performance Cluster Computing Architectures and Systems, Prentice Hall PTR
2. K.R. Wadleigh and I.L. Crawford, Software Optimization for High Performance Computing: Creating Faster Applications", Hewlett-Packard professional books, PHI.
3. J. Dongara, I. Foster, G. Fox, W. Gropp, K. Kennedy, L. Torczon, and A. White, Sourcebook of Parallel Programming", Morgan Kaufmann
4. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability", McGraw Hill
5. David A. Bader,Petascale Computing: Algorithms and Applications, Chapman & Hall/CRC Computational Science Series
6. David Culler Jaswinder Pal Singh, Parallel Computer Architecture: A hardware/Software Approach, Morgan Kaufmann
7. Kai Hwang , Scalable Parallel Computing", McGraw Hill
8. Research Papers on advanced topics from Journals/Conference Proceedings

3CS1108 Advance Computer Networks [3 0 1 4]

Course Learning Outcome:

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

- understand the congestion control and queuing models in network
- demonstrate the knowledge of modern networking concepts and data center network planning
- apply the concepts learnt in this course to optimize performance of modern networks
- design and configure networks to support a specified set of applications

Syllabus:

Network Concepts: Introduction to Computer Networks, Networking Principles, Constant Bit Rate and Variable Bit Rate Network Services, Network Elements, Multiplexing, Switching, Error Control, Flow Control

Congestion Control: Performance of networks, delay and throughput, TCP congestion control, Analysis of TCP, QoS and fairness, traffic shaping and congestion control in TCP

Routing: Router scheduling algorithms, Router architectures, Border Routing protocols, MPLS

Software Defined Networking: Data Plane, Control Plane, Application Plane, Controller design, Virtualization, OpenFlow protocol for SDN, Network Function Virtualization

Data Center Networking: Data center architectures, Data center congestion control, queuing and traffic patterns, Data center network protocols, End host architectures, multipath TCP, Low Latency protocols for Data center, Load balancing

Applications: Distributed hash tables, Peer-to-peer systems, Content delivery networks, multimedia networks, Video streaming networks, Health networks, White Space Networking – WhiteFi

Self Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 8 experiments to be incorporated..

References:

1. William Stallings, Foundations of Modern Networking (SDN, NFV, QoE, IoT and Cloud), Pearson
2. William Stallings, High-speed networks and Internets – Performance and Quality of Service, PHI
3. James Kurose and Keith Ross, Computer Networking: A Top-Down Approach, Pearson
4. Hans W. Barz, Gregory A. Bassett, Multimedia Networks: Protocols, Design and Applications, Wiley
5. Rajkumar Buyya, Mukaddim Pathan and Athena Vakali, Content Delivery Networks, Springer
6. Relevant research papers for the topics

Communication Techniques [3 1 0 4]

3CS3103

Course Learning Outcome:
After successful completion of the course, student will be able to

- understand fundamentals in analog and digital communication system
- apply knowledge of probability and random processes in communication systems
- understand various modulation techniques, multiplexing techniques
- analyze the strengths and weaknesses of various communication Systems
- understand the different channel coding methods
- realize different radio propagation issues in communication systems

Syllabus:
Probability and random variables, functions of one random variable, two random variables, stochastic processes, stationary, non-stationary and ergodic processes,
Modulation and Coding Trade-Offs: Goals of the Communications system Designs- Error Probability Plane- Nyquist Minimum Bandwidth- Shannon –Hartley Capacity theorem- Bandwidth Efficiency Plane- Modulation and Coding Trade –Offs- Design and Evaluation of Digital Communication Systems- Bandwidth –Efficient Modulation, Modulation and Coding for Band limited channels- Trellis-Coded Modulation .
Synchronization: Introduction- Receiver Synchronizer- Network Synchronization
Multiplexing and Multiple Access: Allocation of the Communications Resource- Multiple Access Communications System and Architecture- Access Algorithms
Information and coding theory: Entropy, channel capacity, Vector spaces, basis, independence, linear codes, block codes, convolutional codes, Viterbi decoding, turbo codes, LDPC codes.
Fading Channels: Introduction - Characterizing Mobile-Radio Propagation- - Signal Time –Spreading,- Time Variance of the Channel Caused by Motion- Mitigating the Degradation Effects of Fading- Key Parameters Characterizing Fading Channels,- Mitigating the Effects of Frequency-Selective channel.

Self Study:
The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Tutorial Work:
Tutorial work will be based on above syllabus with minimum 10 tutorials to be incorporated.

References:

1. Andy Bateman, Digital Communications: Design for the Real World, PHI
2. Bernard Sklar, Digital communications: fundamentals and applications, PHI
3. Proakis, Digital Communications, McGraw-Hill
4. Papoulis, Probability, random variables and stochastic processes, McGraw-Hill
5. Shu Lin, Error control coding , Pearson Education

3CS1105 Comprehensive Assessment – I [0 0 0 1]

Course Learning Outcome:

After successful completion of the course, student will be able to

- realize the collective understanding of various courses studied in the semester

Syllabus

Student will be assessed on the basis of all the courses learned till end of the respective semester.

3CS1103 Data Structure and Algorithms [3 0 1 4]

Course Learning Outcome:

After successful completion of the course, student will be able to

- identify the appropriate data structure and algorithm design method for the given application
- evaluate various techniques for searching, sorting and recurrence
- analyze and design efficient algorithms
- calculate and conclude the associated algorithms' operations and complexity

Syllabus:

Elementary Data Structures: Arrays, stack, queues, linked list, sorting techniques, Hash Tables, Binary Search Trees, B-Trees, Binomial heaps

Mathematical Preliminaries: Algorithm analysis, Algorithm Proof Techniques, Analysis of Algorithms

Growth of Functions: Analyzing Control Structures, Using a barometer, Average case analysis, Amortized Analysis, Solving recurrences

Greedy Algorithms: Making change, graphs and minimum spanning tree, knapsack problem, Scheduling

Divide and Conquer: General Template, various algorithm implementation e.g. Binary search, Heapsort, Quick Sort, Finding the median, matrix multiplication

Dynamic Programming: Introduction of Dynamic Programming, Principle of Optimality, Comparison with divide and conquer, single source shortest paths, Chained matrix multiplication

Graphs: Elementary Graph Algorithms, DFS, BFS, Backtracking, The knapsack problem, Eight Queens problem, Branch and bound: The assignment problem

Computational Complexity and NP-Completeness: The classes of P and NP, Polynomial reductions, NP-complete problems, NP completeness proofs, NP hard problems, Non-Deterministic algorithms

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 5 experiments to be incorporated.

References:

1. Gilles Brassard and Paul Bratley, Fundamentals of Algorithmics, PHI
2. Thomas Cormen, Introduction to Algorithms, PHI
3. Trembly and Sorenson, Data Structure and Algorithms,PHI

3CS1101 High Speed Networks [3 - 1 4]

Course Learning Outcome

After successful completion of this course, students will be able to:

- Describe and interpret the basics of high speed networking technologies
- Apply the concept learnt in this course to optimize and troubleshoot high-speed network
- Demonstrate the knowledge of network planning and optimization.
- Design and configure network that have outcome characteristics needed to support a specified set of applications

Syllabus

Introduction to Computer Networks, Networking Principles, Constant Bit Rate, Variable Bit Rate Network Services, Network Elements, Multiplexing, Switching, Error Control, Flow Control
Introduction to High Speed Networks, Analysis of Network traffic using deterministic and stochastic Models, Simulation tools, Tele-traffic engineering, Queuing Models
High Speed TCP Variants, Congestion Control in TCP/IP, ATM
High Speed LAN, Gigabit Ethernet, Distributed Queue Dual Bus (DQDB)
Protocols for QoS Support: IntServ, DiffServ, RSVP, MPLS
Optical Fiber Transmission, TCP/IP Performance over Optical Networks, Fiber Distributed Data Interface, Switched Multi-Megabit Dual Service(SMDS)
Applications demanding high speed communication, Multimedia IP broadcasting, Error resilience in Multimedia Transmission, Satellite Broadcasting

Self Learning Component

To be decided by course coordinator at the beginning of semester, which will be a blend of one or more of the e-Learning Resources, Video Lectures, Online courses, tools, research material, web links etc. along with the related assessment component(s).

Laboratory Work

Above concepts are to be implemented and at-least 5 experiments are to be carried out.

References:

1. High-speed networks and Internets – Performance and quality of service by William Stallings
2. High Performance TCP/IP Networking: Concepts, issues and solutions: By Mahoob Hassan Raj and Jain
3. High-speed networks: TCP/IP and ATM design principles by William Stallings
4. High speed networks by Marc Boisseau, Michel Demange, Jean-Marie Munier
5. Multimedia Communications: Applications, Networks, Protocols and Standards, Fred Halsall, Addison –Wesley

3CS3105 Information and Network Security [3 0 1 4]

Course Learning Outcome:

After successful completion of the course, student will be able to

- explore the operating system development from the security perspective
- understand various attacks and their counter-measures
- design applications with necessary security requirements

Syllabus:

Protection and in Operating systems, memory and addressing, protecting objects and files, user authentication, security in distributed systems, design of trusted operating systems, encryption algorithms, Encrypted file systems. Network security architectures, IP security, Firewall engineering, Encapsulating payloads, authentication header, key exchange, Security in wireless networks access control, WPA, RSN, RADIUS etc.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 5 experiments to be incorporated.

References

1. Charles Pflegger and Pflegger, Computer Security, Pearson
2. N. Doraswamy and Dan Harkins, IPSec: The New Security Standard for the Internet, Intranets, and Virtual Private Networks, PHI
3. William Stallings, Cryptography and Network Security, PHI

3CS1E28 Artificial Intelligence [3 0 1 4]

Course Learning Outcome:
After successful completion of this course, student will be able to

- understand concept of knowledge representation and predicate logic and transform the real life information in different representation
- understand state space and its searching strategies
- analyze a system and its implementation

Syllabus:
Introduction to Artificial Intelligence Overview: What is AI, Importance, and early work in AI, AI related fields.
Knowledge: General concepts, definition and importance of knowledge, knowledge based system, representation, organization, manipulation and acquisition of knowledge.
Problems, Problem Spaces and State Space Search: The AI Problems, The Underlying Assumption, What Is An AI Techniques, The Level Of The Model, Criteria For Success, Some General References, One Final Word. Defining The Problems As a State Space Search, Production Systems, Production Characteristics, Production System Characteristics, and Issues In The Design Of Search Programs.
Knowledge Representation: Knowledge Representation Issues, Representations And Mappings, Approaches to knowledge Representation, Using Predicate Logic Representation Simple Facts in Logic, Representing Instance and ISA Relationships, Computable Functions And Predicates, Resolution. Representing Knowledge Using Rules, Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning.
Weak Slot-And-Filler Structure : Semantic Nets, Frames.
Search and Control Strategies : Uninformed(Blind) and informed search, DFS, BFS, Heuristic Search Techniques : Generate-And-Test, Hill Climbing, Best-First Search, A*, AO*, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.
Reasoning : Symbolic Reasoning Under Uncertainty, Introduction to Non-monotonic Reasoning, Logics for Non-monotonic Reasoning. Statistical Reasoning , Probability And Bay's Theorem, Certainty Factors And Rule-Base Systems, Bayesian Networks, Dempster-Shafer Theory.
Game Playing: Overview and Example Domain, Min-max Search, Adding Alpha-Beta Cutoffs.
Expert System: Introduction, Architecture, and Types of Expert Systems.

Self Study:
The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:
Laboratory work will be based on above syllabus with minimum 5 experiments to be incorporated.

References:

1. Elaine Rich And Kevin Knight, Artificial Intelligence and Expert Systems, Tata McGraw-Hill.
2. D.W.Patterson, Artificial Intelligence and Expert System, Development, W.Rolston, Mcgraw-Hill International Edition.
3. Ivan Bratko, Introduction to Prolog Programming Carl Townsend PROLOG Programming for Artificial Intelligence, Addison-Wesley
4. ClocksinAndMellish, "Programming with PROLOG", Stuart Russell.
5. Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall.

3CS1E13 Cloud Computing [3 0 1 4]

Course Learning Outcome:

After successful completion of this course, student will be able to

- describe the hardware and software concepts and architecture of cloud computing
- contrast the key technical and commercial issues concerning cloud computing versus traditional software models
- recognize the importance of virtualization technology in support of cloud computing
- explore the issues related to cloud computing data centres

Syllabus:

Foundations: Distributed system models and enabling technologies, computer clusters for scalable Computing, Introduction to Cloud Computing, On the Management of Virtual Machines for Cloud Infrastructures, Migrating to the cloud, virtual machines and virtualization of clusters and datacenters, Applications of Virtual Machines, Nested Virtualization

Cloud services: Infrastructure as a service, Virtual Machines Provisioning and Migration Services, Platform as a service , Enhancing Cloud Computing Environments

Using a Cluster as a Service, Software as a Service, SLA Management in Cloud Computing, Performance Prediction for HPC on Clouds, Workflow Engine for Clouds, Understanding Scientific Applications for Cloud Environments, The MapReduce Programming Model and Implementations,

Monitoring and Management of Cloud: A Service Provider's Perspective, Best PracticesinArchitecting Cloud Applications, Building Content Delivery Networks Using Clouds,Resource Cloud Mashups,Security in cloud, Governance and Case Studies, Legal Issues in Cloud Computing, Achieving Production Readiness for Cloud Services Exploring prototypes and present day clouds.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 5 experiments to be incorporated.

References:

1. RajkumarBuyya, James Broberg,Andrzej M Goscinski, Cloud Computing: Principles and Paradigms, Wiley Publication.
2. Kai Hwang, Jack Dongarra& Geoffrey C. Fox, Distributed and Cloud Computing: Clusters, Grids, Clouds and the Future Internet, Elsevier
3. Gautam Shroff, Enterprise Cloud Computing: Technology, Architecture, and Applications, Cambridge University Pres
4. Toby Velte, Anthony Velte, Cloud Computing, A Practical Approach, McGraw-Hill Osborne Media, McGraw-Hill
5. Selected Research Papers from Various Sources.

3CS1205 Comprehensive Assessment – II [000 1]

Course Learning Outcome:

After successful completion of the course, student will be able to

- realize the collective understanding of various courses studied in the semester

Syllabus:

Student will be assessed on the basis of all the courses learned till end of the respective semester.

3CS1E23 Data Warehousing and Mining [3 0 1 4]

Course Learning Outcome:
After successful completion of this course, student will be able to

- identify the key processes of data mining, data warehousing and knowledge discovery process
- understand the basic principles and algorithms used in practical data mining and their strengths and weaknesses
- apply data mining techniques to solve problems in other disciplines in a mathematical way

Syllabus:
Introduction, Multidimensional Data Model, Data Warehouse & OLAP Technology for Data Mining, Architecture, Differences of Data warehouse and Data mart, Data Preprocessing, Preprocessing Techniques, Data Mining Primitive, Language & System Architecture.
Concept Description: Characterization and Comparison, Attribute Oriented Induction.
Mining Association rules in large database, Techniques for frequent pattern mining.
Classification & Prediction: Classifier, ID3, C4.5, Regression. Cluster analysis, clustering techniques.
Applications of Mining
Intelligent Functionalities of Warehouse: Querying and Reporting, Online Analytical Processing, Data mining and Executive information systems (EIS).
Case study of some available OLAP tools.

Self Study:
The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:
Laboratory work will be based on above syllabus with minimum 5 experiments to be incorporated.

References:

1. Jiahei Han &MichelineKamber, Data Mining Concepts and Techniques, Morgan Kaufmann
2. S. Nagabhushana, Data Warehousing OLAP and Data Mining, New Age publishers

3CS3202 Information Retrieval Systems [3 0 1 4]

Course Learning Outcome:

After successful completion of the course, student will be able to

- understand concepts, algorithms, data/file structures necessary to design, and implement IR systems
- apply methodology for the design and evaluation of IR systems
- compare major types of IR systems, the different theoretical foundations underlying these systems
- develop the practical skills for IR systems design

Syllabus:

Overview of IR Systems, Architecture of information retrieval systems
Document Representation: Statistical Characteristics of Text, Basic Query Processing.
Data Structure and File Organization for IR: Retrieval Models: Similarity Measures and Ranking, Boolean Matching, Vector Space Models, Probabilistic Models, Automatic Indexing and Indexing Models
Search and Filtering Techniques: Relevance Feedback, User Profiles, Collaborative Filtering
Classification: Automatic classification, Document and Term Clustering, Document Categorization Heuristic classification, Nearest Neighbor, Naive Bayes Methods, Support Vector Machines
Machine Learning Techniques in IR: Neural Networks, Genetic Algorithms, Symbolic Learning
Indexing and storage issues, Information visualization and usage pattern analysis
IR Systems and the WWW, PageRank and Hyperlink Analysis, Search Personalization
N-Grams in Information Retrieval, Agent-based Information Retrieval
Parallel and Distributed IR, Multimedia IR: Models and Languages
Cross-Language and Multilingual Information Retrieval, Retrieval from noisy documents
Performance Evaluation of Information Retrieval Systems

Self Learning Component

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work

Laboratory work will be based on above syllabus with minimum 5 experiments to be incorporated.

References

1. C.D. Manning, P. Raghavan, H. Schütze, Introduction to Information Retrieval, Cambridge UP
2. R. Baeza-Yates, B. Ribeiro-Neto, Modern Information Retrieval, Addison-Wesley
3. D.A. Grossman, O. Frieder, Information Retrieval: Algorithms and Heuristics, Springer
4. W.B. Croft, J. Lafferty, Language Modeling for Information Retrieval, Springer
5. G. Kowalski, M.T. Maybury, Information Storage and Retrieval Systems, Springer
6. Grigoris Antoniou and Frank van Harmelen, A Semantic Web Primer, The MIT Press
7. B. Croft, D. Metzler, T. Strohman, Information Retrieval in Practice, Pearson Education

3CS1E35 Machine Learning [3 0 1 4]

Course Learning Outcomes

After successful completion of this course, student will be able to

- have exposure to machine learning concepts and range of problems that can be handled by machine learning
- compare and parameterize different learning algorithms
- apply the machine learning concepts in real life problems

Syllabus

Introduction: Motivation and Applications

Regression Techniques: Regression, Simple Linear Regression – Gradient Descent and Normal Equations Method, Multiple Linear Regression, Non-Linear Regression, Linear Regression with Regularization, Support Vector Regression, Evaluation Measures for Regression Analysis

Classification Techniques: Naïve Bayes Classification: Fitting Multivariate Bernoulli Distribution, Gaussian Distribution and Multinomial Distribution, K-Nearest Neighbours, Classification Trees, Linear Discriminant Analysis, Support Vector Machines: Hard Margin and Soft Margin, Kernels and Kernel Trick, Evaluation Measures for Classification

Artificial Neural Networks: Biological Neurons and Biological Neural Networks, Perceptron Learning, Activation Functions, Multilayer Perceptrons, Back-propagation Neural Networks, Learning with Momentum, Winner-take-all Learning, Competitive Neural Networks

Clustering: Hierarchical Agglomerative Clustering, k-means Algorithm, Self-Organizing Maps

The PAC and mistake bound learning frame work, VC dimension

Self-Learning Component

To be decided by course coordinator at the beginning of semester, which will be a blend of one or more of the e-Learning Resources, Video Lectures, Online courses, tools, research material, web links etc. along with the related assessment component(s).

Laboratory Work

Above concepts are to be implemented and at least 5 experiments are to be carried out.

References

1. C. Bishop, Pattern Recognition and Machine Learning, Springer
2. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification and Scene Analysis, Wiley
3. Kishan Mehrotra, Chilukuri Mohan and Sanjay Ranka, Elements of Artificial Neural Networks, Penram International
4. Tom Mitchell, Machine Learning, TMH
5. Rajjan Shinghal, Pattern Recognition, Techniques and Applications, OXFORD
6. Athem Ealpaydin, Introduction to Machine Learning, PHI
7. Andries P. Engelbrecht, Computational Intelligence - An Introduction, Wiley Publication

3CS1E07 Modern Databases [3 0 1 4]

Course Learning Outcome:

After successful completion of this course, student will be able to

- understand query processing and optimization for various centralized / distributed databases
- understand new-generation data models used for highly distributed databases
- design and deploy various column oriented, document oriented, key-value stores and graph databases
- apply tools and techniques for applications related to social networks and similar systems

Syllabus:

Principles of query processing, Indexing techniques, Query execution plans and operators, Query optimization Next-generation data models, Aggregate Data Models ,declarative query language, Distribution Models

Databases Vs. File Systems: GFS, HDFS, Big Data, Bigtable/HBASE Row-oriented Vs. column-oriented storage Advanced indexing methods, Scalable data processing , Parallel query plans and operators, massively parallel joins

Systems based on MapReduce: Hadoop, Hive

Scalable Key-Value Stores: Amazon Dynamo, Cassandra No-SQL Databases, Document Store database

Distributed Data: Parallel Computing with Monad algebra, NESL, DryadLINQ, PigLatin Graph Databases, Grid & Cloud Database Solutions Large-Scale Graph Processing: Pregel

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 5 experiments to be incorporated.

References:

1. Martin Fowler, Pramod J. Sadalage,NoSQL Distilled, Pearson.
2. Elmasri and Navathe,Fundamentals of Database Systems, 6th Ed Addison Wesley.
3. Garcia-Molina, Ullman and Widom, Database Systems: The Complete Book, Pearson.
4. Connolly and Begg, Database Systems, Addison Wesley.
5. J. Hellerstein& M. Stonebraker,THE RED BOOK: Readings in Database Systems, MIT Press.
6. Selected research papers relevant to the course topics

3CS3201 Network Embedded Systems [3 0 1 4]

Course Learning Outcome:

After successful completion of the course, student will be able to

- understand the fundamentals of embedded systems programming, real-time operating systems
- develop understanding of power-aware protocols for networks of small devices
- explore newly established standards for embedded systems and ubiquitous computing

Syllabus:

Introductionto Networked Embedded Systems, Embedded Distributed Systems, Embedded Processors Overview,Operating Systems for Communication-Centric Devices, Sensor Network Applications, Sensor Network Platforms, Embedded Systems Programming, Signal Behaviors and Sensor Interfaces, Location Discovery Algorithms, Localization Techniques, Time Synchronization and Calibration, Radio Technologies and Medium access protocols, Data Aggregation, Clustering and Aggregation, Mobility and Collaborative Control, Collaborative Signal Processing, Robust Embedded Networking,IP-based Wireless Sensor Networks, 6LoWPAN and IP Concepts, Constrained Application Protocol with 6LoWPAN, Embedded Web Services,Security Issues and Data Integrity for Wireless Embedded Systems, Firmware and Applications for the Internet of Things

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 5 experiments to be incorporated.

References:

1. Pottie and Kaiser, Principles of Embedded Network Design, Cambridge University Press
2. Zhao and Guibas, Wireless Sensor Networks, An Information Processing Approach, Morgan Kaufmann
3. Andrew Ryan Dalton, Analysis, Instrumentation, and Visualization of Embedded Network Systems: A Testbed-based Approach, ProQuest
4. Embedded, Everywhere:A Research Agenda for Networked Systems of Embedded Computers, National Academies Press

3CS3204 Networked Embedded Systems [3 0 1 4]

Course Learning Outcome:

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

- comprehend the fundamentals of networked embedded systems,
- explore newly established standards and protocols for IoT and ubiquitous computing,
- design energy aware applications for IoT networks of small devices.

Syllabus:

Introduction to Networked Embedded Systems (NES): Embedded Distributed Systems, Embedded Processor **architectures**, Operating Systems for Communication-Centric Devices, **basics of Sensor Networks, Node Architecture, Sensor Network Platforms and Applications**

Embedded Web Services**: Integrating Internet Services with Interoperable data encoding with XML and JSON, Sensor data models and representation, The Sensor Mark-up Language (SENML): data model and encoding in XML and JSON**

Robust Embedded Networking: IP-based Wireless Sensor Networks, **IEEE 802.15.4: features, topologies, addressing and MAC frame format,** Low-power and Lossy Network - 6LoWPAN and IP Concepts, **IPv6 structure, addressing, routing, interconnecting issues, 6LoWPAN - forwarding, addressing, header compression, neighbor discovery**

Routing: **Routing in LLN, RPL for LLN, Trickle algorithm, RPL loop detection and routing performance**, Constrained Application Protocol with 6LoWPAN

IoT and NES: **IoT messaging standard MQTT, AMQP, XMPP,** Security Issues and Data Integrity for Wireless Embedded Systems, Firmware and Applications for the Internet of Things

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 5 experiments to be performed.

References:

5. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, Wiley Pulications
6. Pottie and Kaiser, Principles of Embedded Network Design, Cambridge University Press
7. Dr. Ovidiu Vermesan, Dr. Peter Friess, Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, River Publishers
8. Jean-Philippe Vasseur, Adam Dunkels, Interconnecting Smart Objects with IP: The Next Internet, Morgan Kuffmann
9. Zhao and Guibas, Wireless Sensor Networks, An Information Processing Approach, Morgan Kaufmann
10. Zach Shelby, Carsten Bormann, 6LoWPAN: The Wireless Embedded Internet, Wiley

3CS1201 Research Seminar [00 1 1]

Course Learning Outcome:

After successful completion of the course, student will be able to

- compare the work done by various researchers in the area of interest using literature survey
- identify the research gaps in the specific area of interest
- demonstrate practical aspect of research contribution
- comprehend and document the study and contribution made towards research

Syllabus:

Candidates have to select any Research Topic as Self Study for their Research Seminar. They will be required to present the progress of their Study in front of the Reviewing Panel at Regular intervals. During the final review, student are required to submit the report of Seminar.

3CS1E34 Securing High Performance Computing Environment [3 0 1 4]

Course Learning Outcome:
After successful completion of this course, student will be able to

- understand the area of information and network security through the high end computing standards like cluster computing, cloud computing and grid computing
- develop an insight into the high end processing capabilities of nodes
- analyze scientific applications needing multiple cores
- identify highly useable and cost efficient cloud computing capabilities to meet national scale requirements for new modes of computationally intensive scientific research

Syllabus:
Introduction, need and general purpose issues of high performance computing. Overview of Various HPC Systems, Techniques for achieving security in multi-user computer systems, Security problems in computing, **Security in Distributed Computing** - Security and content distribution networks, Key management and agreement in Distributed systems, Security in Autonomic Computing
Security in Cloud Computing - Introduction to Cloud Computing, concepts of security in Cloud, Cloud security challenges, Infrastructure security, Data security and storage in Cloud, data dispersal techniques, High-availability and integrity layer for cloud storage , Encryption and key management in the cloud , Cloud forensics , Data security and Storage, Data location and availability, Data security tools and techniques for the Cloud, Trustworthy Cloud infrastructures , Secure computations , Cloud related regulatory and compliance issues, Prototypes of Cloud service providers.
Security in Grid Computing - Grid Security Architecture and Infrastructure, Standards and Models for Grid Security, Trust based access control management framework for a secured grid environment, Single Sign-On, Unifying grid and organizational security mechanisms

Self Study:
The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:
Laboratory work will be based on above syllabus with minimum 5 experiments to be incorporated.

References:

1. Mather, T., Kumaraswamy S., and Latif, S. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance. O'Reilly Media.
2. Terrence V Lillard, Digital Forensics for Network, Internet, and Cloud Computing: A Forensic Evidence Guide for Moving Targets and Data, Syngress Publication.
3. Charles P Pfleeger, Shari Lawrence Pfleeger, Security in Computing, Prentice Hall.
4. Yang Xiao**,** Security in Distributed, Grid, Mobile, and Pervasive Computing,Auerbach Publications.
5. John Rittinqhouse, James Ransome. Cloud Computing, Implementation, Management and Security, CRC Press.

3CS1E25 Semantic Web [3 0 1 4]

Course Learning Outcomes

After successful completion of this course, student will be able to

- understand the principles behind semantic web and Ontology Engineering
- model and design ontologies using Resource Description Framework (RDF) and Web Ontology Language (OWL)
- query ontologies using SPARQL
- apply semantic web technologies to real world applications

Syllabus

History, Semantic Web Layers, Semantic Web technologies, Semantics in Semantic Web

XML: Structuring, Namespaces, Addressing, Querying, Processing, Metadata, Traditional Search vs. Semantic Search

RDF and Semantic Web: RDF Specification , RDF Syntax, XML and Non-XML, RDF elements, RDF Relationship, Reification, Container and Collaboration , RDF Schema, Editing, Parsing, and Browsing RDF/XML, RQL, RDQL, SPARQL, Web Data Management,

Ontology: Ontology Movement, OWL, OWL Specification, OWL Elements, OWL Constructs, Simple and Complex, Ontology Engineering, Constructing Ontologies, Reusing ontologies, Ontology Reasoners, On To Knowledge Semantic Web architecture, Ontology Mapping, Alignment and Merging Tools, Ontology Editor

Logic and Inference: Logic, Description Logics, Rules, Monotonic Rules, Syntax, Semantics and Examples, Non Monotonic Rules, Motivation, Syntax, and Examples, Rule Markup in XML, Monotonic Rules and Non Monotonic Rules

Applications of Semantic Web Technologies: Commercial and Non Commercial Use of RDF, Sample Ontology, Web Services, Web Mining, Horizontal information, Data Integration, Future of Semantic Web

Self-Learning Component

To be decided by course coordinator at the beginning of semester, which will be a blend of one or more of the e-Learning Resources, Video Lectures, Online courses, tools, research material, web links etc. along with the related assessment component(s).

Laboratory Work

Above concepts are to be implemented and at least 5 experiments are to be carried out.

References

1. Grigorous Antoniou and Van Hermelen, A Semantic Web Primer, The MIT Press.
2. Dieter Fensel, Jim Hendler, Henry Lieberman and Wolfgang Wahister, Spinning the Semantic Web: Bringing the World Wide Web to Its Full Potential, The MIT Press.
3. Shelley Powers, Practical RDF, O'Reilly Publishers.
4. Manish Joshi, Harold Boley, Rajendra Akerkar, Advances in Semantic Computing, Techno Mathematics Research Foundation
5. Elliotte Rusty Harold, The XML 1.1 Bible, Wiley.

3CS1E04 Software Testing and Quality Assurance [3 0 1 4]

Course Learning Outcome:
After successful completion of this course, student will be able to

- learn and develop project documentations and soft skills for effective project presentation
- develop practical skills related to software quality assurance
- apply software testing techniques for information systems development

Syllabus:
Software Quality, Role of testing, verification and validation, White-Box and Black-Box Testing , Test Planning and Design, Monitoring and Measuring Test Execution, Test Tools and Automation, Test Team Organization and Management.
Unit Testing: Concept of Unit Testing, Static Unit Testing, Defect Prevention, Mutation Testing, Debugging, Unit Testing in eXtreme Programming
Control Flow Testing: Control Flow Graph, Paths in a Control Flow Graph, All-Path Coverage Criterion, Statement Coverage Criterion, Branch Coverage Criterion, Examples of Test Data Selection.
Data Flow Testing: Data Flow Anomaly, Data Flow Graph, Data Flow Testing Criteria, Feasible Paths and Test Selection Criteria, Comparison of Testing Techniques.
System Integration Testing: Types of Interfaces and Interface Errors, System Integration Techniques, Software and Hardware Integration, Off-the-Shelf Component Testing, Built-in Testing
System Test Categories: Basic Tests, Functionality Tests, Robustness Tests, Interoperability Tests, Performance Tests, Scalability Tests, Stress Tests, Load and Stability Tests, Reliability Tests, Regression Tests, Documentation Tests.
Functional Testing: Equivalence Class Partitioning, Boundary Value Analysis, Decision Tables, Random Testing, Error Guessing, Category Partition.
System Test Design: Test Design Factors, Requirement Identification, Characteristics of Testable Requirements, Test Design Preparedness Metrics, Test Case Design Effectiveness
System Test Planning and Automation: Structure of a System Test Plan, System Test Automation
System Test Execution: Metrics for Tracking System Test, Beta Testing, System Test Report, Product Sustaining, Measuring Test Effectiveness.
Acceptance Testing: Types of Acceptance Testing, Selection of Acceptance Criteria, Acceptance Test Execution, Acceptance Testing in eXtreme Programming.
Software Quality: Five Views of Software Quality, McCall's Quality Factors and Criteria, Quality Factors Quality Criteria, Relationship between Quality Factors and Criteria, Quality Metrics, ISO 9126 Quality Characteristics, ISO 9000:2000 Software Quality Standard ISO 9000:2000 Fundamentals, ISO 9001:2000 Requirements

Self Study:
The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:
Laboratory work will be based on above syllabus with minimum 5 experiments to be incorporated.

References:

1. SagarNaik University of Waterloo, PiyuTripathy, Software Testing and Quality Assurance: Theory and Practice, Wiley.
2. William Perry, Effective Methods for Software Testing, Wiley.
3. Paul C. Jorgensen,Software Testing - A Craftsman's Approach, CRC Press.
4. Srinivasan Desikan and GopalaswamyRamesh,Software Testing, Pearson Education.

5. Louis Tamres,Introducing to Software Testing, Addison Wesley Publications.
6. Ron Patton, SAMS Techmedia Indian Edition,Software Testing, Pearson Education.
7. Glenford J. Myers,The Art of Software Testing, John Wiley & Sons.
8. Robert V. Binder, Testing Object-Oriented Systems: Models Patterns and Tools, Addison Wesley.
9. Daniel Galin, Software Quality Assurance, Pearson Education.

3CS1E24 Web Search and Mining [3 0 1 4]

Course Learning Outcome:

After successful completion of this course, student will be able to

- identify and differentiate between application areas for web content mining, web structure mining and web usage mining
- understand how web search engines crawl, index, and rank web content
- understand the functionality of the various web search and web mining methods and components

Syllabus:

Introduction to web mining, Taxonomy of web mining, Architecture of a general purpose web search engine such as google or alta vista Web Content Mining: document indexing and retrieval in the web environment - Boolean and vector retrieval models, latent semantic indexing (LSI), results ordering, meta-search, Indexing and Retrieval, Standard and extended query languages for web data. Indexing and retrieving text files by words. Database structure. Measuring the relevance of a text to a query, web documents categorization and clustering

Natural Language Processing Methods Used For Web Information Retrieval: lemmatization, part-of-speech tagging, disambiguation, shallow syntactic parsing etc.

Web Structure Mining: primary web browsing (crawling, spidering),focused crowling, link topology analysis, PageRank, HITS methods ,Global analysis of the Web

Social Networks Analysis Web Usage Mining: mining for user behavior on the web, internet marketing, Information Extraction as a specific type of web content mining: wrapper-based vs. token activated extraction

Specific Applications: opinion mining vs. fact mining, web spam analysis, comparative shopping, etc. Web information integration, mapping schemas usage

Web Mining And Its Relation To The Semantic Web: automatic semantic annotation, ontology learning, Semantic Web search The invisible web and specialized search engines.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 5 experiments to be incorporated.

References

1. SoumenCharkabarti, Mining The Web: Discovering Knowledge from Hypertext Data*,* Morgan Kaufmann.
2. RichardoBaeza-Yates and BerthierRibierno-Neto*,* Modern Information RetrievalAddison Wesley.
3. Alfred and Emily Glossbrenner, Search Engines for The World Wide Web*,* Peachpit Press.

3CS3203 Wireless Networks [3 0 1 4]

Course Learning Outcome:

After successful completion of the course, student will be able to

- understand fundamentals of wireless communications
- analyze security, energy efficiency, mobility, scalability, and their unique characteristics in wireless networks
- demonstrate basic skills for cellular networks design
- apply knowledge of TCP/IP extensions for mobile and wireless networking

Syllabus:

Fundamentals of Wireless Communication; Wireless LAN, PAN, WAN and MAN; Wireless Internet
Cellular Networks: GSM, Channel allocation, Network planning, Security, CDMA, DSSS, Spreading code, IS-95 Standard, Mobile IP, Cellular IP,
GPRS: Architecture and role of the components,
Wireless Ad-hoc Networks: Introduction; Game theory, MAC, Network and Transport layer protocols; QoS, Security and Energy Management, Topology management, Mobility models

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 5 experiments to be incorporated.

References:

1. C. Siva Ram Murthy and B.S. Manoj, Ad Hoc Wireless Networks – Architectures an Protocols, Pearson Education
2. Perkins, Wireless Ad hoc Network, Pearson Education
3. Jochen Schiller, Mobile Communications, Pearson Education
4. Theodore Rappaport , Wireless Communications: Principles and Practice, Prentice Hall

3CS1301 Project Part I [00 30 13]

Course Learning Outcome:

After successful completion of the course, student will be able to

- compare the work done by various researchers in the area of interest using literature survey
- identify specific research gaps
- correlate other facets of research through innovative thinking and ideas
- demonstrate effective communication skills
- apply optimization and enhancement skillsfor effective research
- employ ethical practices for research

Syllabus:

The student will carry out a project with significant technical contribution either in the institute, any R&D organization or Industry. At the end of the semester III, student will submit a report on the progress of his work.

3CS1401 Project Part II [00 30 14]

Course Learning Outcome:

After successful completion of the course, student will be able to

- compare the work done by various researchers in the area of interest using literature survey
- identify specific research gaps
- correlate other facets of research through innovative thinking and ideas
- demonstrate effective communication skills
- apply optimization and enhancement skillsfor effective research
- employ ethical practices for research

Syllabus:

The student will continue the project work started in semester III and complete the work defined and submit final dissertation for evaluation.