I Semester (25Credits)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Code</th>
<th>Subject</th>
<th>Credits</th>
<th>C.I.A.</th>
<th>SEE</th>
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<tr>
<td>1</td>
<td>15CSE101</td>
<td>Advanced Computer Architecture and Parallel Programming</td>
<td>4+1+0+0</td>
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<td>2</td>
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<td>3</td>
<td>15CSE103</td>
<td>Wireless Networks</td>
<td>4+0+1+0</td>
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<td>4</td>
<td>15CSE11*</td>
<td>Elective-I</td>
<td>4+0+0+1</td>
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<td>15CSE12*</td>
<td>Elective-II</td>
<td>4+0+0+1</td>
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Elective I
1. Digital Image Processing
2. Cloud Infrastructure & Service Management
3. Bioinformatics & Genetic algorithms
4. Mathematical Foundation for Computer Science
5. VLSI & CAD
6. Analysis of Computer Networks

Elective-II
1. Web Technologies
2. Computer Systems Performance Analysis
3. Adv.Unix Prg. & Device Drivers
4. Pattern Recognition & Fuzzy Logic
5. Human Computer Interaction
6. Cellular networks
7. Computer Vision: Foundations and Applications

Note:
- Continuous Internal Assessment (CIA) involves both theory tests and practical evaluation.
- There will be SEE for lab component of Core subjects of I and II Semester.
- Where ever there is a combined theory and lab, students must score minimum passing marks in each of the component.
- SEE question paper will contain 2 questions from each unit. Student must answer one full question from each unit.
- M.Tech(CSE) course is an interdisciplinary course, where undergraduates from computer science, information science, electronics and communication, electrical and electronics and instrumentation technology are eligible for admission. However, computer science and information science undergraduates are encouraged to take electives, which they have not studied during their BE degree course.
- Self study components under elective subjects, include referring to advanced topics related to the subject from Technical journals and giving a seminar and a write-up.
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Code</th>
<th>Subject</th>
<th>Credits</th>
<th>C.I.A.</th>
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<td>15CSE201</td>
<td>Data Base Management &amp; Data mining</td>
<td>4+0+1+0</td>
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<td>15CSE202</td>
<td>Software Engineering</td>
<td>4+1+0+0</td>
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<td>15CSE203</td>
<td>System Software</td>
<td>4+0+1+0</td>
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<td>15CSE21*</td>
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<td>15CSE22*</td>
<td>Elective-IV</td>
<td>4+0+0+1</td>
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**Elective III**

1. Storage Technologies
2. Graphics, Multimedia & Gaming techniques
3. Decision Support System & ERP
4. Computer Security
5. Embedded system & RTOS
6. Distributed Systems
7. Artificial Intelligence & machine learning

**Elective-IV**

1. Network Management
2. Cryptography & network Security
3. Information theory & coding
4. Compiler optimization & Multicore architecture
5. Game theory
6. Formal models in computer science
7. General Purpose Computation on GPU
8. Big Data Management
NMAM INSTITUTE OF TECHNOLOGY, NITTE  
SCHEME OF TEACHING AND EXAMINATION FOR  
M.TECH.COMPUTER SCIENCE & ENGINEERING  
(AUTONOMOUS SCHEME: 2015-2017 )  

III Semester  

(20 Credits)  

<table>
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<th>Sl. No.</th>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Duration</th>
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<th>EXAM</th>
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<tr>
<td>1</td>
<td>15CSE301</td>
<td>Industrial Training/ Mini Project /Certification Exam</td>
<td>Full Time 8 weeks</td>
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<tr>
<td>2</td>
<td>15CSE302</td>
<td>Seminar +Technical paper writing</td>
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<tr>
<td>3</td>
<td>15CSE303</td>
<td>Project (Problem Statement, Literature Survey, Initial Design )</td>
<td>Remaining weeks of 3rd sem.</td>
<td>200</td>
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</table>
## NMAM INSTITUTE OF TECHNOLOGY, NITTE
### SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH.COMPUTER SCIENCE & ENGINEERING
(AUTONOMOUS SCHEME: 2015-2017 )

### IV Semester

(30 Credits)

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Duration</th>
<th>C.I.A.</th>
<th>EXAM</th>
<th>Credits</th>
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<tr>
<td>15CSE401</td>
<td>Project (Continued from 3(^{rd}) Semester: Project Implementation, Testing and Report submission)</td>
<td>Full time</td>
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<td>Report = 200 Viva-voce =200</td>
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**GRAND TOTAL** From 1\(^{st}\) to 4\(^{th}\) semester : 100 credits
## ADVANCED COMPUTER ARCHITECTURE AND PARALLEL PROGRAMMING

**Course Code:** 15CSE101  
**Credits:** 5  
**Teaching Hours:** 52  

| UNIT – I |  
| --- | ---  
| **Fundamentals of Computer Design:** Introduction, Classes of Computers, Measuring, reporting and summarizing performance, quantitative principles of computer design | 3 Hrs  
| **Computer Arithmetic:** Introduction, Basic Techniques of Integer Arithmetic, Floating Point: Floating-Point Multiplication, Floating-Point Addition, Division and Remainder. | 7 Hrs  

| UNIT – II |  
| --- | ---  
| **Instruction Level Parallelism, Its Exploitation and Limits on ILP:** Introduction to pipelining, the major hurdle of pipelining- pipeline hazards, How is pipelining implemented. | 3 Hrs  
| **ILP and its exploitation:** Concepts and Challenges, Basic compiler techniques for exposing ILP, Reducing branch cost with prediction, overcoming data hazards with dynamic scheduling, hardware based speculation, exploiting ILP using multiple issues and static scheduling, exploiting ILP using Dynamic scheduling, multiple issue and speculation, advanced techniques for instruction delivery and speculation. Case study of Pentium 4. Introduction to limits on ILP. | 7 Hrs  

| UNIT – III |  
| --- | ---  
| **Memory Hierarchy Design, Storage Systems:** Review of basic concepts; Crosscutting issues in the design of memory hierarchies; Case study of AMD Opteron memory hierarchy. | 5 Hrs  
| **Hardware and Software for VLIW and EPIC:** Introduction: Exploiting Instruction-Level Parallelism Statically, Detecting and Enhancing Loop-Level Parallelism, Scheduling and Structuring Code for Parallelism, Hardware Support for Exposing Parallelism: Predicated Instructions, Hardware Support for Compiler Speculation, The Intel IA-64 Architecture and Itanium Processor. | 5 Hrs  

| UNIT – IV |  
| --- | ---  
| **Introduction to High Performance Computing:** What is high performance computing?-Motivation, Applications, Challenges. HPC Computer architecture models: SIMD, MIMD, SPMD; HPC Communication models: Shared Address Space vs. Message Passing. | 5 Hrs  
| **Distributed-Memory Parallelism:** Parallel Algorithm Design, Parallel Programming with MPI, The Message Passing Programming Model, Blocking vs. Non blocking communications, MPI program Anatomy & communicators, MPI program to Parallel Matrix Multiplication. | 5 Hrs  

| UNIT – V |  
| --- | ---  
| **Shared-Memory Parallelism:** Basic Patterns in Pthreads, Mutual Exclusion in Pthreads, Basic Patterns in OpenMP, Mutual Exclusion in OpenMP. | 4 Hrs  

L-T-P-S: 4+1+0+0  
CIE: 50  
SEE: 50
Hybrids & Accelerators: Hybrid Architectures, MPI+OpenMP- Use MPI and OpenMP in the same application. Introduction to GPGPU computing with CUDA, Coprocessors-Overview of Intel's Xeon Phi architecture, introduction to programming Intel's Xeon Phi.

Text Books:
2. Parallel Programming in C with MPI and OpenMP by Michael J. Quinn, McGraw-Hill Higher Education 2003
3. CUDA by Example: An Introduction to General-Purpose GPU Programming, Jason Sanders and Edward Kandrot

Reference Books:
1. Introduction to parallel computing, By Ananth Grama, Addison-Wesley 2nd ed. (2003)
3. Online resources for MPI, OpenMP, CUDA and Xeon Phi programming

ADVANCED ALGORITHMS

Course Code: 15CSE102
Credits: 5
Teaching Hours: 52

L-T-P-S: 4+0+1+0
CIE: 50
SEE: 50

UNIT-I
10 Hrs

UNIT-II
12 Hrs
Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson’s Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching.

UNIT-III
10 Hrs
Parallel Algorithms:Parallel Algorithm Models; Performance Metrics for Parallel Systems;Matrix Multiplication;Image dithering;Parallel Merge Sort;Searching a Random Sequence.

UNIT-IV
10 Hrs
String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.
UNIT V 10Hrs
Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms.

Text Books:


Reference books:


WIRELESS NETWORKS

Subject Code: 15CSE103
Total Hours: 52
Hours/ Week: 04
Exam Hours: 3

Unit I 10 Hours

Unit II 08 Hours
Unit III 12 Hours

802.11i: Robust Security Networks, Temporal Key Integrity Protocol (TKIP), Counter Mode with CBC-MAC (CCMP), Robust Security Network (RSN) Operations.

Unit IV 12 Hours


Unit V 10 Hours

Wireless WAN/MAN: Cellular Concept: Capacity enhancement, Channel Allocation, Handoffs.
TCP in Wireless domain: Traditional TCP, Link layer solutions, Split approach based solutions, end-to-end solutions.

Textbooks:
1. 802.11 Wireless Networks: The definitive guide, 2nd Edition, Matthew Gast, O'Reilly Publisher, 2005. (Chapter 2, 3, 4, 5, 6, 7, 8, 10, 11, 12)
UNIT- I
Image Enhancement in the Spatial Domain - Background, Some Basic Gray Level Transformations, Histogram Processing. 7 Hrs

UNIT- II
Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters,
Image Enhancement in the Frequency Domain- Background, Introduction to the Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters, 8 Hrs

UNIT- III
Sharpening Frequency Domain Filters, Homomorphic Filtering.
Image Segmentation- Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Segmentation by Morphological Watersheds, the Use of Motion in Segmentation 8 Hrs

UNIT- IV
Image Compression - Fundamentals Image Compression, Models Elements of Information, Theory Error-Free Compression, Lossy Compression, Image Compression Standards
Morphological Image Processing - Preliminaries, Dilation and Erosion, Opening and Closing, the Hit-or-Miss Transformation Some Basic, Morphological Algorithms 8 Hrs

UNIT- V

TEXT BOOKS:

REFERENCES:

CLOUD INFRASTRUCTURE AND SERVICE MANAGEMENT

Subject Code: 15CSE112

Course Objectives:
1. To describe transition from classic data center to virtualized data center to cloud
2. To describe virtualization technology at compute, storage, network and desktop layer
3. To describe business continuity solutions in a Virtual Data Center(VDC) environment and to describe key deployment models of cloud computing
4. To describe cloud infrastructure components and security concerns and protection mechanism in a cloud

Course outcome: Students at the end of the course will be able to appreciate the need and importance of cloud environment and virtualization. Various Cloud deployment models, security concerns and protection mechanisms will be understood by the learners.
Hands-on exercise to understand the concepts of cloud infrastructure and service management

Unit I

Classic data center and its elements, Challenges and benefits. Virtualization of compute, storage and network. Definition of cloud computing. Steps in transitioning to cloud-consolidation, automation, IT as a service.
Compute – Physical and logical components. Storage –Media and options, RAID and concept of LUN. Network – Physical components and Protocols
Storage networking technologies- DAS, FC SAN, IP SAN, FCoE, NAS, Object based storage.
Business continuity – Need, Terminologies, solutions. Backup and Recovery – Overview, methods, components and operation, Data de-duplication. Replication- Overview, consistency, local and remote replication technologies, Data center management

Unit-II

Compute Virtualization – Challenges of x86 hardware virtualization, Hypervisor- Type 1 and 2. Full, para and hardware assisted virtualization. Virtual machine, VM disk files BIOS files and swap files, virtual machine hardware- CPU, memory, disk, network interface and other devices.
Resource management. VMFS, Physical and virtual machine conversion- benefits, options process
Storage virtualization – LVM, NAS volume management- AVM, storage pool, Block and file level virtualization, Thin provisioning and automated storage tiering
Network virtualization – Networking in VDC, Virtual NIC, Switch, router, VLAN and VSAN technologies, VLASN tagging modes- VST, EST and VGT. Private VLAN, Network traffic management, NIC teaming, Network I/O control, Multipathing
Application and Desktop virtualization - Application virtualization – different layers, user profile virtualization, application streaming and encapsulation, benefits. Desktop virtualization-methods – client based and compute based

Unit-III

10 hours
Business continuity in Virtual Data center – Fault tolerance mechanism, clusteing, protecting network. Backup in VDC – approaches, array based backup of VM, Image based backup, Deduplication in VDC, Replication and migration, host based and storage array based, VM migration
Drivers for cloud computing, Grid and utility computing, virtualization, SOA. Characteristics of Cloud computing, Cloud service offering examples, economics of cloud computing – co-location, managed service provider and cloud. Cloud deployment models- public, private, hybrid and community cloud. Cloud service models – Saas, Paas and Iaas. Examples

UNIT-IV

10 hours
Cloud infrastructure and Management – Cloud infrastructure framework, Cloud OS, cloud services, security infrastructure, Stakeholders for cloud service – service provider, broker and consumer. Monitoring and management –service portfolio management, catalog management asset and configuration management, change management incident and availability management
Migration to cloud – Migrating the existing applications, Migration considerations- cost saving, interoperability, SLA and transparency, security and compliance

UNIT-V

10 hours
Security, Basics, confidentiality, integrating and availability (CIA), Authentication, authorization and auditing (AAA), trusted computing base(TCB), Denial of service and distributed denial of service.
References:
2. Cloud computing for dummies – Judith Hurwitz

BIOINFORMATICS AND GENETIC ALGORITHMS

Subject Code: 15CSE113

UNIT I

Introduction To Basics Of Molecular Biology
Basic cell architecture, The structure, content and scale of DNA, History of human genome, genes and proteins, Current Knowledge and ‘central dogma’, Why proteins are important, Gene and Cell regulation, what is Bioinformatics.

Introduction To Problems And Challenges
Introduction, Genome, Transcription, Proteome, Interference Technology, viruses and immune system.

UNIT II

Introduction to search, Search algorithms, Heuristic search methods, Optimal search strategies, Problems with search techniques, Complexity of search, Use of graphs in Bioinformatics, Grammars, languages and automata, Classes of problems.

Probabilistic Approaches:
Bayesian’s Networks, Markov Networks

UNIT III

Nearest Neighbour And Clustering Approaches
Introduction, Nearest neighbor method, Nearest neighbour approach for secondary structure protein folding prediction, Clustering, Advanced clustering techniques.

Identification (Decision) Trees
Method, Gain criterion, Over fitting and pruning, Application guidelines, Bioinformatics applications.

Neural Networks
Method, Application guidelines, Bioinformatics applications, Background.
UNIT IV

Genetic Algorithms 11 Hrs
Single objective genetic algorithms method, single objective genetic algorithms example, Multi objective genetic algorithms method, Application guidelines, Genetic algorithms – Bioinformatics applications.

UNIT V

Genetic Programming 6 Hrs
Method, Application guidelines, Bioinformatics applications, Background.
Cellular Automata 6 Hrs
Method, Application guidelines, Bioinformatics applications, Background

Textbook:

1. Intelligent Bioinformatics, The application of artificial intelligence techniques to bioinformatics problems by Edward Keedwell and Ajit Narayanan.

Reference Books:


MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Subject code: 15CSE114

UNIT I 14 Hrs

1.1 Finite Automata and Regular Expressions:
Finite state systems, Basic definitions, Non deterministic finite automata, finite automata with E-moves, Regular expressions, Two-way finite automata, finite automata with output, applications of finite automata. 8 Hrs
Properties of Regular Sets:
The pumping lemma for regular sets, Closure properties of regular sets, Minimization of finite automata. 6 hrs

UNIT II 15 Hrs

2.1 Context-free Grammars:
Context free grammars, Derivation trees, Simplification of Context Free Grammars, Chomsky normal form, Greibach normal form. 7 Hrs.
2.2 Pushdown Automata:
Definitions, PDA and context free languages.
Properties of Context-free languages:
The pumping lemma for CFLs, Closure properties of CFLs, Ogden’s Lemma 3 Hrs.
UNIT III

3.1 Turing Machines:
The TM model, Computable languages and functions, Techniques for Turing machine construction, Modifications of Turing Machines, Church’s hypothesis.

3.2 Tractable and Intractable Problems-
P and NP, Polynomial –Time Reductions and NP – Completeness, Cook’s Theorem, Other NP – Complete Problems

UNIT IV

4.0 Basics of Queuing Theory:
Overview and definitions, M/M/1 queues, Little’s Formula, M/M/1/K Queues, M/M/m queues, Networks of Queues.

UNIT V

5.0 The Predicate Calculus:
Predicates, The statement function, Variables and quantifiers, Predicate Formulas, Free and Bound variables, The Universe of Discourse.

Text Books:

1. Introduction to Languages and The Theory of Computation by John C. Martin 3rd Edition

Reference Books:

2. An Introduction to Formal Languages and Automata by Peter Linz, 2nd Edition
VLSI & CAD

Subject code: 15CSE115

UNIT I


11 hours

UNIT II

**High level synthesis:** Synthesis, Y-chart Partitioning in High level Synthesis, Introduction, Partitioning, Basic Partitioning Methods: Random Selection, Clustering Growth, Hierarchical Clustering, Simulated Annealing


14 hours

UNIT III

**Logic Synthesis:** Algebraic and Boolean Division Shannon’s expansion theorem, Binary Decision Diagrams (BDD), ROBDD, ITE graphs, Combinational Optimization, PLAs, Two level optimization – PLA Folding, Multilevel logic circuits and Optimization.

10 hours

UNIT IV

**Physical Synthesis:** Floor Planning Placement, Routing, Compaction Algorithms.

09 hours

UNIT V

VHDL, language constructs, entity and architecture, behavioral description, structural description, examples, Testbenches
12 hours

Text & Reference Books:

1. VLSI CAD – Niranjan N.Chiplunkar & Manjunath Kothari, PHI Learning, 2011
3. VHDL Programming - Douglas Perry, TMH
5. Logic synthesis and Verification Algorithms – Gary Hatchel and Fabio somenzi, Kluwer Academic

ANALYSIS OF COMPUTER NETWORKS

Subject Code : 15CSE116

1. Introduction: Two examples of analysis: Efficient transport of packet voice calls, Achievable throughput in an input-queuing packet switch; The importance of quantitative modeling in the Engineering of Telecommunication Networks.


3. Stream Sessions: Deterministic Network Analysis: Events and processes in packet multiplexer models: Universal concepts; Deterministic traffic models and Network Calculus; Scheduling; Application to a packet voice example; Connection setup: The RSVP approach; Scheduling (continued).

3. Stream Sessions: Stochastic Analysis: Deterministic analysis can yield loose bounds; Stochastic traffic models; Additional notation; Performance measures; Little’s theorem, Brumelle’s theorem, and applications; Multiplexer analysis with stationary and ergodic traffic; The effective bandwidth approach for admission control; Application to the packet voice example; Stochastic analysis with shaped traffic; Multihop networks; Long-Range-Dependent traffic.

4. Adaptive Bandwidth Sharing for Elastic Traffic: Elastic transfers in a Network; Network parameters and performance objectives; Sharing a single link; Rate-Based Control; Window-Based Control: General Principles; TCP: The Internet’s Adaptive Window Protocol; Bandwidth sharing in a Network.
TEXT BOOKS:

REFERENCE BOOKS:

WEB TECHNOLOGIES

Subject Code: 15CSE121

Unit I
Web 2.0 and Client side technologies 12 Hours
What is Web 2.0? Folksonomies and Web 2.0. Software as a service (SaaS). Data and Web 2.0, Convergence, Iterative development, Rich User experience, Multiple Delivery Channels, Social Networking.
Web browsers and Web server, URL, MIME, HTTP, XHTML and HTML, Introduction to CSS, Levels of Style Sheets, Levels of Style Sheets, Style specification formats.
Overview of Java Script, Simple programs on Java script, JavaScript execution environment, Events and Event handling,

Unit II
Server Side Technology – PHP 12 Hours
Introduction to PHP-Origins and uses of PHP, General Syntactic Characteristics, Output, Control statements, Arrays, Functions, Pattern Matching, Form Handling, Files, Cookies, Session Tracking. Database Access through the Web-Relational Database, An Introduction to SQL, Architecture for database access, The MySQL database system, Database Access with PHP and MySQL.


UNIT-III
XML and web services 10 Hours
XML basics, the syntax of XML, XML document structure, Document type definitions. Working with Namespaces. XML schema, displaying raw XML documents, Displaying XML documents with CSS, XSLT style sheets, XML processors.
SOAP, RPC style SOAP, Document style SOAP, WSDL, REST services, JSON format, What is JSON? Array literals, Object literals, Mixing literals, JSON syntax, JSON Encoding and Decoding. JSON versus XML

UNIT-IV

Building Rich Internet Applications with AJAX 10 Hours
Limitation of Classic Web application model, AJAX principles, Technologies behind AJAX, Examples of usage of AJAX, Dynamic web applications through Hidden frames of both GET and POST methods, IIFrames, Asynchronous communication and AJAX application model. XMLHttpRequest object – properties and methods, handling different browser implementations of XMLHttpRequest, The same origin policy, Cache control, AJAX patterns, predictive fetch patterns, submission throttling pattern, Periodic refresh, multi stage download, Fall back patterns, Introduction to Flex, Basic concepts of flex programming

UNIT-V

Networking and Java beans 12 Hours

What is a Java Bean, Advantages of Java Beans, Introspection, Using Bound and Constrained Properties, Persistence, Customizers, The Java Beans API, A Bean Example

Text books:
1. Harvey M. Deitel and Paul J. Deitel, Internet & World Wide Web How to Program, 4/e
COMPUTER SYSTEMS PERFORMANCE ANALYSIS

Subject Code: 15CSE122


3. Monitors, Program Execution Monitors and Accounting Logs: Monitors: Terminology and classification; Software and hardware monitors, Software versus hardware monitors, Firmware and hybrid monitors, Distributed System Monitors, Program Execution Monitors and Accounting Logs, Program Execution Monitors, Techniques for Improving Program Performance, Accounting Logs, Analysis and Interpretation of Accounting log data, Using accounting logs to answer commonly asked questions.

4. Capacity Planning and Benchmarking: Steps in capacity planning and management; Problems in Capacity Planning; Common Mistakes in Benchmarking; Benchmarking Games; Load Drivers; Remote-Terminal Emulation; Components of an RTE; Limitations of RTEs.


6. Queuing Models: Introduction: Queuing Notation; Rules for all Queues; Little’s Law, Types of Stochastic Process. Analysis of Single Queue: Birth-Death Processes; M/M/1 Queue; M/M/m Queue; M/M/m/B Queue with finite buffers; Results for other M/M/1 Queuing Systems. Queuing Networks: Open and Closed Queuing Networks; Product form networks, queuing Network models of Computer Systems. Operational Laws: Utilization Law; Forced Flow Law; Little’s Law; General Response Time Law; Interactive Response Time Law; Bottleneck Analysis; Mean Value Analysis and Related Techniques; Analysis of Open Queuing Networks; Mean Value Analysis; Approximate MVA; Balanced Job Bounds; Convolution Algorithm, Distribution of Jobs in a System, Convolution Algorithm for Computing G(N), Computing Performance using G(N), Timesharing Systems, Hierarchical Decomposition of Large Queuing Networks: Load Dependent Service Centers, Hierarchical Decomposition, Limitations of Queuing Theory.
ADVANCED UNIX PROGRAMMING & DEVICE DRIVERS

Subject Code: 15CSE123

UNIT I
POSIX APIs, Unix files, Unix file APIs, Unix Processes, Process control, semaphores, mutexes, Process relationships. 10 hrs

UNIT-II
Signals and daemon processes, IPCs, mails boxes, queues. Deadlocks, prevention. 10 hrs

UNIT-III
The role of the device driver, splitting the kernel, Classes of devices and Modules, Security issues, version numbering, Building and Running Modules: Setting up your test system, the hello world module, kernel modules verses applications, compiling and loading, kernel symbol table, preliminaries, initialization and shutdown, module parameters. Char Drivers:The design of scull, major and minor numbers, important data structures, char device registration, open and release, scull’s memory usage, read and write. 12 Hrs

UNIT IV
Debugging support in the kernel, debugging by printing, querying, watching, debugging system faults, debuggers and related tools. Concurrency and Race Conditions. Advanced Char Driver Operations, ioctl, Blocking I/O, poll and select, Synchronous notification, seeking a device, Access control on a device file. Allocating Memory: The real story of kmalloc, Lookaside Caches, get-free-page and friends, Per-CPU variables, obtaining large buffers. Communicating with Hardware: I/O ports and I/O memory, using I/O ports, an I/O port example, using I/O memory. 11 Hrs

UNIT V
Preparing the parallel port, installing an interrupt handler, implementing a handler, top and bottom halves, interrupt sharing, interrupt driven I/O. Data Types in the Kernel: Use of standard C types, assigning an explicit size to data items, interface specific types, Linked Lists. USB
Drivers: USB Device basics, USB and Sysfs, USB Urbs, Writing a USB Driver, USB Transfers without Urbs. Memory Mapping and DMA: Memory management in LINUX, the mmap device operation, performing direct I/O, Direct memory access. Block Drivers: Registration, the block device operations, request processing. Network Drivers: How snuff is designed, connecting to the kernel, the net_device structure, opening and closing, packet transmission, packet reception, the interrupt handler, receive interrupt migration, changes in link state, the socket buffers, MAC address resolution, custom ioctl commands.

Text Books:
2. W. Richard Stevens: Advanced Programming in the Unix Environment, Addison-Wesley

Reference Books:
3. Maurice J. Bach: The design of the Unix Operating System, Pearson Education

PATTERN RECOGNITION & FUZZY LOGIC

Subject Code: 15CSE124

Unit-I


8 hours

Unit-II


9 hours

Unit-III

Linear discriminant functions: Introduction, linear discriminant functions, generalized linear discriminant functions, minimizing the Perceptron criterion function, relaxation procedures, nonseparable behaviours, minimum squared-error procedures, Ho-Kashyap procedures.

**13 hours**

**Unit-IV**


**13 hours**

**Unit-V**


**13 hours**

**Text Books :**

HUMAN COMPUTER INTERACTION

Sub code: 15CSE125

UNIT- I
Introduction to Human-Computer interaction. Interface Design practices and methods- User centered principles and methods. 12 hours

UNIT II
Current trends in HCI research. HCI design process – An integrated perspective. 11 hours

UNIT III
Strategies for improving web site usability. Usability Engineering. 11 hours

UNIT IV
Application of usability and design principles to the evaluation of current interface. Methods for collecting users’ requirements and analyzing users’ tasks. Usability analysis and evaluation of product designs. 11 hours

UNIT V
Ubiquitous & Wearable Computations, Privacy & Security, Advanced topics in HCI. 11 hours

TEXT BOOKS:

1. Interaction design: Beyond Human-Computer Interaction, 2nd edition
   Helen Sharp, Yvonne Rogers and Jennifer Preece John Wiley and Sons, 2007
   ISBN: 978-0-470-01866-8

2. Designing the User Interface, 4th edition Ben Shneiderman and Catherine Plaisant Addison – Wesley, 2005
   ISBN: 0-321-19786-0

3. Recent Conference proceedings.
CELLULAR NETWORKS

Subject Code : 15CSE126

UNIT-I 11 Hours


2. Modern Wireless Communications Systems: Second generation (2G), Cellular Networks, evolution of 2.5G, TDMA Standards, Third Generation (3G) Wireless Networks, Wireless Local Loop (WLL) and LMDS, Wireless Local Area Networks (WLANs), Bluetooth and Personal Area Networks (PANS)

UNIT-II 11 Hours

3. The Cellular Concept: System Design Fundamentals, Introduction, Frequency reuse, channel assignment strategies, handoff strategies – prioritizing handoffs, Practical Handoff considerations. Interference and system capacity, co-channel interference and system capacity, channel planning for wireless systems, adjacent channel interference, power control for reducing interference.


UNIT-III 10 Hours


UNIT-IV 10 Hours

6A. Multiple Access Techniques for Wireless Communications: Introduction to Multiple access, Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Spread Spectrum Multiple Access, Space Division Multiple Access (SDMA),

UNIT-V 10 Hours


TEXT BOOKS:

REFERENCE BOOKS:

COMPUTER VISION: FOUNDATIONS AND APPLICATIONS

Subject code: 15CSE127

UNIT-I

Case Study: OpenCV & Matlab (Task)
09 hours

UNIT-II

Pixels, Features, and Cameras: Pixels and Filters: Images as functions, Linear Systems (filters), Convolution & Correlation. Edge detection: Simple, Canny, RANSAC; Feature detector: Local invariant, Harris, DOG, SIFT; Camera Models.
Case Study: Advanced 3D Vision Topics and Applications (Task)
11 hours

UNIT-III

Case Study: Panaromic Image Stitching. (Task)
10 hours
UNIT-IV

Regions of Images, and Segmentation: Basic Concepts of Segmentation: Gestalt theory; Agglomerative, K-means & Mean-shift Clustering; Optical flow, Feature tracking, Applications; Advanced Image Parsing Topic and Applications: Binary, Image Matting; Figure-ground Segmentation Using Clustering Algorithms.

Case Study: Co-Segmentation techniques: Histogram matching, iCoseg, Stereo, Object discovery, Scene Parsing, In & out of focus segmentation. (Task)

14 hours

UNIT-V

Recognizing Faces and Objects: Basic Concepts in Recognition & its pipeline, Nearest Neighbor Match; PCA and Eigenfaces; Tracking Millions of People: Detection, Tracklet Generation & Association;

Case Study: Perception Systems for Self-Driving Cars; Towards the AI. (Task)

09 hours

Text books:


Reference books:

DATABASE MANAGEMENT SYSTEMS AND DATA MINING

Subject code: 15CSE201

Unit - I


Ch. 1 Entity-Relationship Model (Data Modeling): Entity-Relationship (ER) Model, Entities and Entity types, Relationship and Relationship type, Constraints, Weak Entity Types, ER Diagrams, The Enhanced Entity-Relationship (EER) Model.

Database design: Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations and Dealing with Constraint Violations; Relational Database Design Using ER-to-Relational Mapping, Theory of Normalization- Normal Forms: First, Second, Third Normal Forms.

05 Hours

04 Hours

Unit – II

Transaction Management and Database Recovery: ACID properties, Concurrent execution of transactions: Lock Based concurrency control, Two phase locking protocol, Database recovery techniques: recovery techniques based on Differed update, Recovery techniques based on immediate update, Shadow paging.


Ch. 4 Enhanced Data Models for Some Advanced Applications: Active database concepts and triggers; Temporal, Spatial, and Deductive Databases – Basic concepts.

04 Hours

Unit – III

Object and Object-Relational Databases: Overview of Object-Oriented Concepts – Objects, Encapsulation, Type and class hierarchies, complex objects; Object model of ODMG, Object definition Language ODL; Object Query Language OQL; Conceptual design of Object database.

Ch. 5 Distributed Databases: Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS; Distributed catalog management; Distributed Query processing; Updating distributed data; Distributed transactions; Distributed Concurrency control and Recovery.

05 Hours

04 Hours

Unit – IV

Data Warehousing – Introduction: Operational Data Stores (ODS), Extraction Transformation Loading (ETL), Data Warehouses Design Issues, and Guidelines for Data Warehouse Implementation, Data Warehouse Metadata.

Ch. 7 Online Analytical Processing (OLAP): Introduction, Characteristics of OLAP systems, Multidimensional view and Data cube, Data Cube Implementations, Data Cube operations, Implementation of OLAP and overview on OLAP Softwares.

05 Hours

Ch. 8 Data Mining: Introduction, Challenges, Data Mining Tasks, Types of Data, Data

03 Hours
Preprocessing, Measures of Similarity and Dissimilarity, Data Mining Applications.

Unit – V


Ch. 10 Clustering Techniques: Overview, Features of cluster analysis, Types of Data and Computing Distance, Types of Cluster Analysis Methods, Partitional Methods, Hierarchical Methods, Density Based Methods, Quality and Validity of Cluster Analysis.

05 Hours

03 Hours

Text Books:

Reference Books:

SOFTWARE ENGINEERING

Subject Code : 15CSE202

UNIT I
Requirement Analysis- Prototyping - Specification - Analysis modeling, UML. 11 Hours

UNIT II
Software Design- Software design - Abstraction - Modularity - Software Architecture - Effective modular design - Cohesion and Coupling - Architectural design and Procedural design - Data flow oriented design. 11 Hours
UNIT III


11 Hours

UNIT IV


11 Hours

UNIT V


12 Hours

TEXT BOOKS:

1. Ian Sommervil le, Software Engineering, Pearson Education Asia

REFERENCE BOOKS:

1. Mall R., Fundamentals of Software Engineering, Prentice Hall of India
SYSTEM SOFTWARE

Subject Code: 15CSE203

UNIT-I 8 hrs

Threads: Overview, Multithreading models, Threading issues.
CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithm.
Process Synchronization: Process Synchronization, Critical Section Problem, Synchronization hardware, Semaphores, Classical problems of synchronization, Critical regions, Monitors.

Dead Locks:
Dead Locks, System Model, Dead Lock Characterization, Methods for handling Dead Locks, Dead Lock Prevention, Dead Lock Avoidance, Dead Lock Detection, Recovery from Dead Lock.

UNIT-II 8 hrs

Memory Management:
Memory management, Background, Swapping, Contiguous memory allocation, Paging, Segmentation, Segmentation with paging.
Virtual Memory and I/O Systems:
Virtual Memory, Background, Demand Paging, Process Creation, Page replacement, Allocation of Frames, Mass Storage structure, Disk Structure, Disk Scheduling methods, Disk Management, Swap Space Management.
Threads and thread programming, Threading APIs, Message passing interface (MPI)
Virtualization concepts – OS virtualization, case study

UNIT-III 10 hrs

Syntax Analysis: The Role of the Parser, Context-free Grammars, Writing a Grammar, Top-down Parsing, Bottom-up Parsing, LR Parsers (upto constructing LA LR Parsing Tables), Parser Generators.

UNIT-IV 9 hrs

Syntax-Directed Translation:
Syntax-Directed definitions, Constructions of Syntax Trees, Bottom-up Evaluation of S-attributed definitions, L-attributed definitions.
**Run-time Environments:**  

**Intermediate Code Generation:** Intermediate Languages, Assignments, Boolean Expressions, Case statements

**UNIT-V**

**Code optimization:** Control flow analysis- basic blocks, induction variables, code and loop optimization, Data flow analysis- live variable analysis, dependence analysis – code reordering, optimizing compilers

**Code Generation:**  
Issues in the design of Code Generator, The Target Machine, Run-time Storage Management, Next-use information, A Simple Code Generator, Register Allocation and Assignment

**Text Book:**

2. Advanced compiler design implementation – Steven S.Muchnick, Morgan Kaufamann publishing, 1997  
3. Andrew S Tanenbaum- *Operating Systems*, Prentice Hall

**Reference Books:**

3. Internet resources for advanced compilation  
5. John R Levine- *Language Processor tools*, O’Reilly Publication
STORAGE TECHNOLOGIES

Subject Code: 15CSE211

UNIT I
11 Hrs
Sources of data and states of data creation, Data center requirements and evolution to accommodate storage needs, The five pillars of technology, Overview of storage infrastructure components, Evolution of Information Lifecycle Management concept, Data categorization within an enterprise, Storage and Regulations.

UNIT II
11 Hrs
Intelligent disk subsystems overview, Component architecture of intelligent disk subsystems, Disk physical structure components, properties, performance, and specifications, Logical partitioning of disks, RAID & parity algorithms, hot sparing, Physical vs. logical disk organization, Interaction of file systems with storage, Storage system connectivity protocols.

UNIT III
11 Hrs

UNIT IV
11 Hrs
Information Availability, Management philosophies (holistic vs. system & component), Industry management standards (SNMP, SMI-S, CIM), Standard framework applications, Key management metrics (thresholds, availability, capacity, security, performance), Metric analysis methodologies & trend analysis.

UNIT V
12 Hrs
Define storage security, List the critical security attributes for information systems, describe the elements of a shared storage model and security extensions, Define storage security domains, List and analyze the common threats in each domain, Identify different virtualization technologies, block-level and file level virtualization technologies.

Text & Reference Books:
1. Information Storage Management, EMC Education Services, Wiley publications.
 GRAPHICS AND MULTIMEDIA

Sub Code  : 15CSE212

UNIT-1

14 Hrs

Introduction, Raster and random scan displays, video controller, Applications of Computer Graphics, Open GL basics

**RASTER GRAPHICS ALGORITHMS :**
Scan converting lines, Scan converting circles, Filling rectangles, Filling Polygons, Clipping lines, Clipping polygons, Antialiasing.

**GEOMETRICAL TRANSFORMATIONS :**
2D Transformations, Homogeneous coordinates and Matrix representation of 2D Transformations, composition of 2D Transformations,

Case study on OpenGL – Basic primitives

UNIT-2

10 Hrs

**GEOMETRICAL TRANSFORMATIONS :**
The window to view port transformation. Matrix representation of 3D Transformations, Transformations as change in coordinate system.

**PROJECTIONS AND VIEWING IN 3D :**
Projections specifying an arbitrary 3D view, Examples of 3D viewing.

Case study on OpenGL – Transformations & animations projections and viewing through camera

UNIT-3

10 Hrs

**CURVES FRACTALS AND SHADING :**
Polygon surfaces, curved lines and surfaces, Quadratic surfaces, Bezier curves & surfaces, Fractal Geometry methods. Illumination models, Shading models for polygons, surface details and shadows.

Case study on OpenGL – fractals and lighting and shading

UNIT-4

10 Hrs

**VISIBLE SURFACE DETERMINATION :**

Case study on OpenGL – Texture mapping
UNIT-5
MULTIMEDIA & GAMING TECHNIQUES

12Hrs

Introduction to Multimedia, File formats: TIFF, GIF, AVI, JPEG and MPEG formats, image compression basics, Gaming techniques

TEXT BOOKS:

DECISION SUPPORT SYSTEM AND ERP

Subject Code: 15CSE213

UNIT I

10 Hours

1. Decision Making and Computerized Support

UNIT II

6 Hours

2. Decision Support Systems-I
3. **Decision Support Systems – II**  
6 Hours


**UNIT III**

12 Hours

4. **Expert Systems**  

**UNIT IV**

6 Hours

1. **Enterprise Resource Planning:**  

4 Hours

2. **Business Engineering and ERP:**  

**UNIT V**

2 Hours

3. **Business Modeling for ERP:**  
An Overview, Building Business Model.

6 Hours

4. **ERP- Implementation:**  
An overview, Role of Consultants, Vendors and Users, Customization, Precautions, ERP-Post Implementation Options, ERP- Implementation Methodology, Guidelines for Implementation.
5. ERP and the Competitive advantage:
   An Overview, ERP and the Competitive strategy.  
   
   **Text Book:**

   **Reference Books:**

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**COMPUTER SECURITY**

**Sub. Code: 15CSE214**

**UNIT-I**

Introduction, threat models, categories of threats, terminology, intel X86 architecture  
   11 hours

**UNIT-II**

Binary disassembly tools, boot viruses, interrupt hooking, memory resident virus, executable file infections.  
   11 hours

**UNIT-III**

Detecting viruses using patterns, regular expressions and lex, obfuscation, defeating obfuscation  
   11 hours

**UNIT-IV**

Introduction to Phoenix and Phoenix binary analysis tools, Anti-anti virus schemes, tunneling, armor, retroviruses, antivirus analysis, SSA form  
   11 hours

**UNIT-V**
Encrypted and oligomorphic virus, polymorphic and metamorphic virus, Software Dynamic translation, security vulnerabilities, exploits, buffer overflow, secure coding, static analyzers, root kits

12 hours

Text:

Reference: www.virusbtn.com

EMBEDDED SYSTEMS & RTOS

Subject Code: 15CSE215

UNIT-I

Embedded system definition, characteristics, design metrics; Processor, IC and design technologies; ASIPs, Embedded system examples, Combinational and sequential building blocks.

10 hours

UNIT-II

Timers, ADCs, Keypad controllers, LCD controllers, stepper motor and DC motor control, Custom Single Purpose processor design examples: GCD Generator. Memory – Composing memory, memory hierarchy and Cache, Advanced RAM.

12 hours

UNIT-III

Introduction to Real – Time Operating Systems: Tasks and Task States, Tasks and Data, Inter-task communication and synchronization, Semaphores, and Shared Data; Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment. Embedded Software development tools, an example RTOS

11 hours

UNIT-IV

Intel ATOM Processor Architecture details, Assembly language programming of ATOM Processor.

11 hours

UNIT-V

Low power Embedded Systems, Design examples using ATOM Processor, Hands-on on ATOM Processor.

12 hours
Text:
1. Frank Vahid, Tony Givargis; Embedded System Design- a unified hardware/software introduction, John Wiley 2002
2. David E.Simon ; An embedded Software Primer, Pearson Education 2002

References:
3. Philip Laplante-“Real time systems design and analysis – an Engineer’s Handbook”, PHI publications
4. Intel Websites

DISTRIBUTED SYSTEMS

Sub. Code: 15CSE216

UNIT-I
System Models: Introduction, architectural models, Fundamental models

UNIT-II
Internet Communication; Introduction, API for the Internet protocols, External data representation and marshalling, Client-Server communication, Group Communication.
Distributed objects and Remote invocation: Introduction, Communication between distributed objects, Remote procedure call, Events and notifications.

UNIT-III
Time and Global States: Introduction, Clocks, events and process states, Synchronizing physical clocks, Logical time and logical clocks, Global states, distributed debugging.

UNIT-IV
Transactions and concurrent control: Introduction, Transactions, Nested Transactions, Locks, Optimistic concurrency control, Time Stamp ordering
Distributed Transadations: Flat and nested distributed transactions, Atomic commit protocols, Concurrency control in distributed transactions , Distributed deadlocks
UNIT-V
Distributed shared memory: Introduction, Design and implementation issues, Sequential consistency and Ivy.
Replication: Introduction to replication, System model and group communication, Fault-tolerant services, Highly available services 10 Hrs

TEXT BOOKS


ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

Subject code:12CSE217

UNIT-I
Introduction to Artificial Intelligence, Applications of AI, Natural Language Processing, Semantic analysis, 11 hours

UNIT-II
Expert Systems: knowledge base and inference engine; case studies, Game Playing , AI languages -Introduction 11hours

UNIT-III
What is Machine learning; Discriminative VS Generative , Concept Learning and the General-to-Specific Ordering , Decision Tree Learning 11 hours

UNIT-IV
ANNs, Evaluating Hypotheses , Bayesian Learning , Computational Learning Theory Instance-Based Learning , Learning Sets of Rules 12 hours
UNIT-V

Analytical Learning , Combining Inductive and Analytical Learning , Reinforcement Learning , ML Applications  

11 hours

Text books:


NETWORK MANAGEMENT

Sub Code: 15CSE221

UNIT-I

Data Communications and Network Management Overview
Analogy of telephone network, Data and telecommunication network, Distributed computing environment, Internet, Protocols and standards, IT management, Network and system management, Current status and future of network management  

12 Hours

UNIT-II

Basic Foundations: Standards, Models, and Language
Network Management Standards, Network Management Model, Organizational Model, Information Model, Communication Model, Abstract Syntax Notation One, TLV Encoding, Functional Model.  

12 Hours

UNIT-III

SNMPv1 Network management: Organization and Information Models

10 Hours

UNIT-IV


06 Hours

SNMP Management: RMON
What is Remote Monitoring? RMON SMI and MIB, RMON1, RMON2, ATM Remote Monitoring, Case Study, Case Study Results  

06 Hours
UNIT-V

Broadband Network management
ATM Technology, ATM Network management, HFC Management, DSL Technology and ADSL Management, Network management applications

10 Hours

Text Book:

CRYPTOGRAPHY AND NETWORK SECURITY

Subject Code: 15CSE222

UNIT I

Foundations of Cryptography and Security: Ciphers and Secret Messages; Security Attacks and Services. Conventional Symmetric Encryption Algorithms: Theory of Block Cipher Design; Feistel Cipher Network Structures; DES and Triple DES; Modes of Operation (ECB, CBC, OFB, CFB); Strength (or Not) of DES; Rijndael (AES).

11 hrs

UNIT II

Modern Symmetric Encryption Algorithms: Blowfish; Key Distribution. Public Key Cryptography: Prime Numbers and Testing for Primality; Factoring Large Numbers; RSA; Diffie-Hellman; Key Exchange Algorithm;

12 hrs

UNIT III

Hashes and Message Digests: Message Authentication; MD5; SHA; Digital Signatures: Certificates, User Authentication; Digital Signature Standard (DSS and DSA). Authentication of Systems: Kerberos V4 and V5; X.509 Authentication Service.

11 hrs

UNIT IV

Elliptic curve cryptography, Electronic Mail Security: Pretty Good Privacy (PGP); S/MIME. IP and Web Security: IPSec and Virtual Private Networks; Secure Sockets and Transport Layer (SSL and TLS).

11 hrs

UNIT V

Electronic Commerce Security: Electronic Payment Systems; Secure Electronic Transaction(SET); CyberCash, iKey Protocols; Digital Watermarking and Steganography, Intrusion detection, Viruses and worms, Firewalls

11 hrs

Text Book:
INFORMATION THEORY AND CODING

Sub Code : 15CSE223

UNIT - I

INFORMATION THEORY AND CHANNEL CAPACITY : Introduction, Measure of Information, Average Information Content of Symbols in Long Independent Sequences, Average Information Content of Symbols in Long Dependent Sequences, Mark-off Statistical Model for Information Sources. Entropy and Information Rate of Mark-Off Sources.

10 hrs.

UNIT – II

Encoding of the Source Output, Shannon’s Encoding Algorithm, Communication Channels, discrete Communication Channels, Rate of Information Transmission Over a Discrete Channel, Capacity of a Discrete Memory Less Channel, discrete Channels with Memory Continuous Channels, Shannon Hartely Law and its Implications.

(Text 1 : Chapter 4 : Section 4.1)

10 hrs.

UNIT – III

FUNDAMENTAL LIMITS ON PERFORMANCE : Some Properties of Entropy, Extension of a DMS, Prefix Coding, Source Coding Theorem, Huffman Coding, Mutual Information, Properties of Mutual Information, Differential Entropy and Mutual Information for Continuous Ensembles.

(Text 2, Chapter 2: Section 2.1 to 2.9)

12 hrs.

UNIT - IV

ERROR CONTROL CODING : Rationale for Coding and Types of Code, Discrete Memory less channels, Examples of Error Control Coding, Methods of Controlling Errors, Types of Errors, Types of Codes, Linear Block Codes, Error Detection and Error Correction Capabilities of Linear block codes. Single Error Correcting Hamming Codes, Lookup Table (or Syndrome) Decoding using Standard Array, Binary Cyclic Codes, Algebraic Structures of Cyclic Codes.

12 hrs.

UNIT – V

Encoding using an (n-k) Bit Shift Register, Syndrome Calculation, Error Detection and Error Correction, BCH Codes, RS Codes, Golay Codes, Shortened Cyclic Codes, Burst Error
Correcting Codes, Shortened Cyclic Codes, Burst Error Correcting Codes. (Text 1, Chapter 9, Section 9.1 to 9.4) Convolution Codes, Time Domain Approach, Transfer Domain Approach, State, Tree and Trellis diagrams, Encoders and Decoders (using Viterbi algorithm only) for (n,k,l) Convolution Codes. (Text 2, Chapter 8 : Section 8.5 to 8.6)

**TEXT BOOKS :**


**REFERENCE BOOKS :**


**COMPILER OPTIMIZATION AND MULTI-CORE ARCHITECTURES**

Sub Code: 15CSE224

**Part-A: Compiler Optimization**

**UNIT-I**

1. **Programming principles:** Reactive parallel programming. Synchronization strategies, critical regions, atomic updates, races, deadlock avoidance, prevention, livelock, starvation, scheduling fairness, virtualization, speculative parallelization, transactional memories.

   11hrs

**UNIT-II**

2. **Optimizations:** Basic compiler optimizations, Control and data flow analysis, Enhancing parallelism, dependence analysis. Tiling for locality and communication, Aggregation for communication, Load balancing strategies, Register Allocation: Coloring, Spilling & IPA, Pointer alias Analysis, Dynamic Code Optimizations and garbage collection, Recent research on Optimization I, Recent Research on Optimization II, Recent Research on optimization III.

   10hrs

3. **Automatic Programming:** Program transformation by pattern matching, Partial evaluation, Object-oriented and Aspect-oriented programming, Automatic Parallelization I, Automatic Parallelization II.

   5hrs

**Part-B: Multi-core Architectures**

**UNIT-III**

4. **Overview of architectures:** Architectural characterization of most important parallel systems today. Issues in effective programming of parallel architectures: exploitation of
parallelism, locality (cache, registers), load balancing, communication, overhead, consistency, coherency, latency avoidance.

UNIT-IV

5. **Programming paradigms:** By the data: Partitioned data, global view of data, and no state. By control: Partitioned control, global view of control, functional control. Survey of programming languages/APIs: OpenMP and MPI

UNIT-V

6. **Tools and Models:** Performance monitors, Debuggers. Simplified models of the issues mentioned above, Exploitation of parallelism (dependence graphs), communication (latency/bandwidth), load balancing, (scheduling theory, practical scheduling algorithms), speedup, efficiency, redundancy, iso efficiency.

Text Books:

2. Lowry and McCartney, eds., Automating Software Design

Supplementary Books:

1. Jones, Gomard, and Sestoft, Partial Evaluation and Automatic Program Generation
3. Maurice Herlihy and Nir Shavit, The Art of Multiprocessor Programming, Morgan Kaufmann
6. William James Dally and Brian Patrick Towles, Principles and Practices of Interconnection Networks, Morgan Kaufmann
7. Sudeep Pasricha and Nikil Dutt, On-Chip Communication Architectures: System on Chip Interconnect Morgan Kaufmann.
GAME THEORY

Sub Code: 15CSE225
Lecture hours/week: 04
Total Hours: 56

UNIT-I

1. Introduction; Strategic Games
   What is game theory? Four elements, Classification of games, The theory of rational choice; Interacting decision makers, Strategic games; Example: The prisoner’s dilemma; Nash equilibrium; Examples of Nash equilibrium; Best-response functions; Dominated actions; Equilibrium in a single population: symmetric games and symmetric equilibria, Interpretation of Nash Equilibrium

UNIT-II

2. Mixed Strategy Equilibrium
   Introduction; Strategic games in which players may randomize; Mixed strategy Nash equilibrium; Finding mixed strategy by graphical method; Finding mixed strategy by analysing subset of all actions; Dominated actions; Pure equilibria when randomization is allowed, examples; The formation of players beliefs; Eliminating dominated actions, Median Voter theorem

UNIT-III

3. Extensive Games
   Extensive games with perfect information; Strategies and outcomes; Nash equilibrium; Subgame perfect equilibrium; Finding subgame perfect equilibria of finite horizon games.
4. Extensions: Allowing for simultaneous moves, examples, Discussion: subgame perfect equilibrium and backward induction.

UNIT-IV

5. Coalition games; The core; examples
6. Bayesian Games: Motivational examples; General definitions; examples
7. Strictly Competitive Games and maximization: Maximization and Nash equilibrium; Strictly Competitive Games; Maximization and Nash equilibrium in strictly competitive games
8. Rationalizability: Iterated elimination of strictly dominated actions; Iterated elimination of weakly dominated actions; Dominance solvability.
UNIT-V

9. Applications of Game Theory
Assumptions and issues in Game theory, Mechanism design problem and examples, game theory and cryptography, game theory and wireless adhoc networks, game theory and network security, Game Theory and Neuronal Networks, Pareto optimal, Selfish routing, Correlated equilibrium

Text Books:

2. An Introduction to Game Theory: Strategy, Joel Watson, W W Norton and Company

Reference Books:


FORMAL MODELS IN COMPUTER SCIENCE

Subject Code : 15CSE226

1. Propositional Logic
   Declarative sentences, Natural deduction, Propositional logic as a formal language, Semantics of propositional logic, Normal forms.

2. Predicate Logic
   The need for a richer language, Predicate logic as a formal language, Proof theory of predicate logic, Semantics of predicate logic, Undecidability of predicate logic, Micromodels of software.

3. Verification by Model Checking
   Motivation for verification, Linear-time temporal logic, Model checking, Branching-time logic, CTL* and the expressive powers of LTL and CTL.

4. Program Verification
   Need for specifying and verifying code, A framework for software verification, Proof calculus for partial correctness and total correctness, Programming by contract.

5. Introduction to Z: Basic concepts; Z notation in Propositional logic and Predicate logic.

Text Books:
GENERAL PURPOSE COMPUTATION ON GPU

Sub code: 15CSE227
Hours/Week:03

UNIT I

Heterogeneous Architecture and Parallel Computing: Introduction to parallel programming, Introduction to heterogeneous architecture- GPU in particular. Introduction to GPU computing, Why GPU, evolution of GPU pipeline and general purpose computation on GPU, GPU architecture case studies: NVIDIA G80, GT200, Fermi, AMD Radeon, AMD Fusion APU etc.

12 hrs

UNIT II

Execution Model: Features of CUDA and OpenCL, Comparision of CUDA and OpenCL, Thread organization, Kernel, error handling, and execution in CUDA and OpenCL.

10 hrs

UNIT III

Programming Model: CUDA Introduction, basics of CUDA C, Complete CUDA structure, basic details of API and libraries, OpenCL overview, OpenCL basic specification, OpenCL C language, Vectorization.

12 hrs

UNIT IV

Memory Model: Introduction to memory model and GPU interaction with CPU, Memory model of CUDA and OpenCL, Memory hierarchy (local/register, shared and global) and optimizations, memory optimized programming, coding tips.

12 hrs

UNIT V

Tools and programming: Introduction to installation and compilation process, usage of tools, profilers and debuggers. CUDA by Examples and OpenCL by Examples, Future Directions.

10 hrs
TEXT BOOKS:
1. Programming massively Parallel Processors: A Hands-on Approach by David B Kirk and Wen-Mei W. Hwu
2. CUDA by Example: An Introduction to General Purpose GPU Programming by Jason Sanders and Edward Kandrot

REFERENCES:
2. NVIDIA CUDA Programming Guide V3.0, NVIDIA
6. GPU Gems 2, M. Pharr (ed.), Addison Wesley, 2005
7. NVIDIA and OpenCL:
9. Open CL at Khronos:
   http://www.khronos.org/developers/library/overview/opencl_overview.pdf
   http://www.khronos.org/registry/cl/specs/opencl-1.0.48.pdf
BIG DATA MANAGEMENT

Course Code: 15CSE228
Credits : 5
Teaching Hours: 52
L-T-P-S: 4+0+0+1
CIE: 50
SEE: 50

Course Objectives:
- To Understand big data for business intelligence
- To Learn business case studies for big data analytics
- To Understand Nosql big data management
- To manage Big data without SQL
- To understanding map-reduce analytics using Hadoop and related tools

TOPICS:

UNIT I UNDERSTANDING BIG DATA 12 Hours

UNIT II NOSQL DATA MANAGEMENT 10 Hours

UNIT III BASICS OF HADOOP 10 Hours

UNIT IV MAPREDUCE APPLICATIONS 10 Hours
MapReduce workflows – unit tests with MRUnit – 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

UNIT V HADOOP RELATED TOOLS 10 Hours

PS: All units must include practical exercises.

TEXT BOOKS:

References: