M. Tech. DEGREE

COMPUTER SCIENCE

SYLLABUS
FOR
CREDIT BASED CURRICULUM
(2009–2010)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY
TIRUCHIRAPPALLI – 620 015, INDIA.
M. Tech. (Computer Science)

The total minimum credits required for completing the M. Tech (Transportation Engineering and Management) Course is 61.

### SEMESTER I

<table>
<thead>
<tr>
<th>Code</th>
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<td>CS701</td>
<td>Advanced Concepts in Operating Systems</td>
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# ELECTIVES (I Semester)

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# ELECTIVES (II Semester)

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CS701. ADVANCED CONCEPTS IN OPERATING SYSTEMS (3-0-0) 3

Multiprocessor operating system - Multiprocessor system architecture, structure, processor scheduling and allocation, memory management.

Distributed operating system- characteristics - Design issues communication models - clock synchronization - Mutual exclusion Election Algorithms.

Distributed Deadlocks detection - Distributed scheduling - Distributed File system - Distributed shared memory.


Real Time Operating System: Scheduling mechanisms, Interrupts, Memory management, I/O & networking, resource reservation.

Case studies: Open source software, LINUX, Open SOLARIS

TEXT BOOK


REFERENCE BOOK


CS703. PARALLEL COMPUTER ARCHITECTURE (3-0-0) 3

Task of a Computer Designer - Measuring and Reporting Performance

Quantitative Principles of Computer Design.

Shared-memory and distributed memory architectures - Taxonomy of MIMD computers

Parallel processing applications - Performance metrics - Speedup performance laws.

Instruction set architecture - Design considerations - CISC & RISC processors - Virtual Memory - Cache memory organization.

Review of the ABCs of Cache Performance issues - Main Memory and Organization for Improving Performance - Memory Technology.


Basic Complier Techniques for Exposing ILP-Static Branch Prediction - the VLIW Approach
- Advanced Compiler Support of Exposing ILP Hardware Support for Exposing More Parallelism at Compile Time Hardware Vs Software Speculation.

**TEXT BOOK**


**CS705. ADVANCED DATA STRUCTURES AND ALGORITHMS (3-0-0) 3**


Linked lists - Linked stacks and queues - Operations on Polynomials Dynamic storage management - Garbage collection and compaction.

Trees - Tree Traversing - Operations on Binary Trees -height balanced trees - graphs and representative graph algorithms.

Selection, Bubble, Insertion, Merge, Heap, Quick, Radix and address calculation - Linear and Binary Searching - Related analysis -Some advanced data structures.


**TEXT BOOK**


**REFERENCE BOOK**


**CS707. SOFTWARE SYSTEMS LABORATORY (0-0-3) 2**


**REFERENCE BOOKS**


**CS702. ADVANCED CONCEPTS IN DATABASE SYSTEMS (3-0-0)3**

Memory hierarchy - Data formats - file structures - Indexes - B-trees Hash tables - external sorting.


Guidelines for index selection - Clustering and indexing - Index tuning, Conceptual Schema tuning, Tuning queries and views.

Log based recovery - undo, redo, undo/redo - logging - Shadow paging - media recovery. Applications: Data Mining, Data warehousing, Web databases.

**TEXT BOOKS**


**REFERENCE BOOK**


**CS704. DISTRIBUTED SYSTEMS (3-0-0)3**


Communication - Layered protocols, RPC, RMI, Message oriented communication, Stream oriented communication, Process - Threads, Clients, Servers, Code Migration, Software agents, Naming - entities, locating mobile entities, removing unreferenced entities

Security, Distributed database systems - CORBA, Distributed COM, Distributed GLOBE, Comparision of CORBA, DCOM, and GLOBE, Distributed File Systems - SUN network file system, CODA file system, other distributed file systems and their comparison.

Distributed document based systems- Word Wide Web, Lotus notes, Distributed Coordination based systems – Introduction, TIB / RENDEZVOUS, JINI and their comparison.
Case Studies: From the Internet - OPEN SOURCE Security, Distributed database systems - CORBA, Distributed database systems, CORBA, Distributed COM, GLOBE, Comparison of CORBA, DCOM, and GLOBE

**TEXT BOOK**


**REFERENCE BOOK**


**CS706: ADVANCED DIGITAL DESIGN (3-0-0)3**

Review of Combinational and Sequential logic design, Structural models of combinational logic, Propagation delay, Behavioral Modeling, Boolean equation based behavioral models of combinational logic, Cyclic behavioral model of flip-flop and latches, A comparison of styles for behavioral modeling, Design documentation with functions and tasks

Synthesis of Combinational and Sequential logic - Introduction to synthesis, Synthesis of combinational logic, Synthesis of sequential logic with latches, Synthesis of three-state devices and bus interfaces, Synthesis of sequential logic with flip-flops, Registered logic, State encoding, Synthesis of gated clocks and clock enables, Anticipating the results of synthesis, Rests, Synthesis of loops, Design traps to avoid, Divide and Conquer: partitioning a design.

Design and Synthesis of Datapath Controllers- Partitioned sequential machines, Design example: Binary counter, Design and synthesis of a RISC stored-program machine, Design example - UART.

Programmable Logic and Storage Devices-Programmable logic devices, Storage devices, Programmable Logic Array (PLA), Programmable Array Logic (PAL), Programmability of PLDs, Complex PLDs, Introduction to Altera and Xilinx FPGAs, Algorithms, Nested loop programs, and data flow graphs, Pipelined Architectures, Circular buffers, FIFOs and Synchronization across clock domains.

Architectures for Arithmetic Processors - Functional units for addition and subtraction, Functional units for multiplication, Multiplication of signed binary numbers, Multiplication of fractions, Functional units for division.

**TEXT BOOK**


**REFERENCE BOOK**


SEMINAR

Students are required to take up a topic of their choice, and by surveying the research done on that topic, they should give a minimum of two presentations. The Students will be required to submit a summary report/paper on the topic.

ELECTIVES FOR FIRST SEMESTER

CS711. FAULT TOLERANT COMPUTING SYSTEMS (3-0-0) 3


Fault Tolerant in Real time Systems - Architecture of Fault-tolerant computers general-purpose commercial systems - High availability systems - Critical computations

Fault Tolerant multiprocessor - Communication Architectures, Shared memory

Interconnections, loop architectures, Tree Networks, Graph Network and in Binary cube interconnection.

Fault Tolerant Software - Design of fault Tolerant software - Reliability Models,

Construction of acceptance tests, validation of Fault tolerant software.

TEXT BOOKS


REFERENCE BOOKS


CS713. DESIGN AND ANALYSIS OF PARALLEL ALGORITHMS (3-0-0) 3

Introduction to Parallel computers - SIMD - EREW, CREW SM-SIMD algorithms - shared memory SIMD, Tree and mesh interconnection computers.
Sorting - Sorting on a Linear Array, Sorting on a Mesh, Sorting on EREW SIMD computer, MIMD Enumeration Sort, MIMD Quick sort. Sorting on other Networks.

Matrix operations - Mesh Transpose, Shuffle Transpose, EREW transpose - Mesh. multiplication, Cube multiplication - Matrix by vector Multiplication Tree Multiplication.


Graph Theoretical Problems - computing the connectivity matrix. Finding connected components, Traversing. The minimal Alpha-Beta Tree, Storage requirements.

**TEXT BOOKS**


**REFERENCE BOOKS**


**CS715. ADVANCED NETWORK PRINCIPLES AND PROTOCOLS (3-0-0) 3**

Introduction to Networks -Application of Networks - Architecture Topology Switching - SLIP, PPP -ALOHA protocols, CSMA/CD, IEEE 802.3, 802.4, 802.5


Network Protocol- IP datagram - hop by hop routing, ARP, RARP, DHCP -Sub net Addressing, Address Masking, ICMP, RIP, RIPV2, OSPF, DNS, LAN and WAN Multicast.


Application Layer Protocol- Telnet - TFTP - FTP - SMTP - Ping Finger, Bootstrap Network Time Protocol- SNMP.

**TEXT BOOK**


**REFERENCE BOOK**

ELECTIVES FOR SECOND SEMESTER

CS714. REAL-TIME SYSTEMS (3-0-0) 3


Task Assignment and Scheduling- Uniprocessor scheduling Algorithms - Task Assignment - Mode Changes - Fault Tolerant Scheduling.


Programming Languages and Tools - Hierarchical decomposition - RunTime error handling - Overloading - Timing specification - Recent trends and developments.

TEXT BOOK


CS716. NETWORK SECURITY (3-0-0) 3

Introduction to Classical and Modern techniques - Attacks, services and mechanisms, classical encryption techniques, DES, Block cipher design principles and modes of operation.


System Security - Backups, integrity management, protecting against programmed threats, viruses and worms, physical security, personnel security.

Network Security - Protection against eavesdropping, security for modems, IP security, web security, electronic mail security, authentication applications.

Security tools - Firewalls, wrappers, proxies, discovering a break-in, denial of service attacks and solutions, Cryptographic security tools: KERBEROS, PGP, SSH, SRP, OPIE.

TEXT BOOKS


REFERENCE BOOK

CS718. MOBILE NETWORK SYSTEMS (3-0-0) 3

Introduction to wireless, mobile and cellular mobile systems- cellular mobile telephone systems, analog and digital cellular systems- frequency reuse, co-channel interference.

Medium access control - MAC, SDMA, FDMA, TDMA, CDMA, Hand offs and dropped calls-initiation of handoff, power difference, mobile assisted cell-site and Intersystem handoff.

Mobile Telecommunication standards, satellite and broadcast systems - GSM, DECT, TETRA, IMT-2000, CTEO, LEO and MEO, - IEEE 802.11, HIPERLAN, Bluetooth.

Network support for mobile systems - Cellular analog, MTSO interconnection, reverse tunneling, IPV6, DHCP, Wireless ATM-W ATM services, functions, radio access layer.

Mobile transport and application layer protocol - Review of traditional TCP, fast retransmit/fast recovery, transmission/timeout freezing, file systems, WWW, WAP.

TEXT BOOK

REFERENCE BOOK

CS720: WIRELESS SENSOR NETWORKS (3-0-0)3

Introduction : Fundamentals of wireless communication technology, the electromagnetic spectrum radio propagation, characteristics of wireless channels, modulation techniques, multiple access techniques, wireless LANs, PANs, WANs, and MANs, Wireless Internet.

Introduction to adhoc/sensor networks: Key definitions of adhoc/ sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, driving applications, issues in adhoc wireless networks, issues in design of sensor network, sensor network architecture, data dissemination and gathering.


QoS and Energy Management : Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmission power, and system power management schemes.
TEXT BOOK


REFERENCE BOOK