Master of Technology
COMPUTER SCIENCE AND ENGINEERING

CURRICULUM AND SYLLABUS
(2016)

DEPARTMENT OF COMPUTER SCIENCE ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY
TIRUCHIRAPPALLI – 620 015, INDIA.
# M. Tech. (CSE) – Curriculum (NITTPGCSE16)

## Semester-wise Curriculum

### I Semester

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Course Code</th>
<th>Course Name</th>
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**Total Credits: 19**

### II Semester

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**Total Credits: 23**
III Semester

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Total Credits: 12

IV Semester

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Total Credits: 12

Summary

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<th>II</th>
<th>III</th>
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Total Credits: 19 + 23 + 12 + 12 = 66
List of Electives

I Semester (2 out of 7)

2. Design and Analysis of Parallel Algorithms : Theory
3. Digital Forensics : Application
4. Principles of Cryptography : Theory
6. Imaging and Multimedia Systems : Application
7. Open Source Programming : Network Systems

II Semester (2 out of 8)

1. Distributed Systems : Network Systems
2. Wireless Sensor Networks : Network Systems
3. Advanced Digital Design : Hardware System
4. Real Time Systems : Network Systems
7. Data Warehousing and Data Mining : Application
8. Cloud Computing : Application
First Semester
CS601: Advanced Algorithms and Data Structures
Credit: 3

Objective
- To introduce and practice advanced algorithms and programming techniques necessary for developing sophisticated computer application programs
- To get accustomed with various programming constructs such as divide-and-conquer, backtracking, and dynamic programming.
- To learn new techniques for solving specific problems more efficiently and for analyzing space and time requirements.

Unit I
Review of order rotation & growth of functions, recurrences, probability distributions, Average case analysis of algorithms, Basic data structures such as stacks, queues, linked lists, and applications.

Unit II
Direct access tables and hash tables, hash functions and relates analysis, Binary Search trees and Operations, AVL Trees and balancing operations, R B Trees, properties, operations.

Unit III
B – Trees – definition – properties, operations, data structures for disjoint sets, Graph algorithms, MST single source all pair shortest paths, BFS, DFS, topological sort, strongly connected components.

Unit IV
Quick sort randomized version, searching in linear time, More graph algorithms – maximal independent sets, coloring vertex cover, introduction to perfect graphs.

Unit V
Algorithmic paradigms Greedy Strategy, Dynamic programming, Backtracking, Branch-and-Bound, Randomized algorithms.

Outcome
- Students are familiar with algorithmic techniques such as brute force, greedy, and divide and conquer.
- Application of advanced abstract data type (ADT) and data structures in solving real world problems.
- Effectively combine fundamental data structures and algorithmic techniques in building a complete algorithmic solution to a given problem.

Text Books
CS603: Advanced Concepts in Operating Systems
Credit: 3

Objectives
- To study the characteristics of OS for Multiprocessor and Multicomputer.
- To learn the issues related to designing OS.
- To learn the latest trends in building Mobile OS.

UNIT I

UNIT II

UNIT III
Distributed scheduling - Distributed shared memory - Distributed File system – Multimedia file systems - File placement - Caching

UNIT IV
Database Operating Systems: Requirements of Database OS – Transaction process model – Synchronization primitives - Concurrency control algorithms

UNIT V
Mobile Operating Systems: ARM and Intel architectures - Power Management - Mobile OS Architectures - Underlying OS - Kernel structure and native level programming - Runtime issues- Approaches to power management

Outcome
- Knowledge about advanced concepts in OS
- Ability to develop OS for distributed systems
- Ability to develop modules for mobile devices

TEXT BOOK:

REFERENCE BOOK
1. A S Tanenbaum, Distributed Operating Systems, Pearson Education Asia, 2001
CS605: Parallel Computer Architecture  
Credit: 3

Objective
- To understand the principles of parallel computer architecture
- To understand the design of parallel computer systems including modern parallel architectures
- To assess the communication and computing possibilities of parallel system architecture and to predict the performance of parallel applications

Unit – I Fundamentals of Computer Design

Unit – II Instruction-Level Parallelism and Its Exploitation

Unit – III Data-Level and Thread-Level Parallelism

Unit – IV Memory Hierarchy Design

Unit – V Storage Systems & Case Studies
Advanced Topics in Disk Storage – Definition and Examples of Real Faults and Failures – I/O Performance, Reliability Measures and Benchmarks – Designing and Evaluating an I/O System – The Internet Archive Cluster
Case Studies / Lab Exercises: INTEL i3, i5, i7 processor cores, NVIDIA GPUs, AMD, ARM processor cores – Simulators – GEM5, CACTI, SIMICS, Multi2sim and INTEL Software development tools.
Outcome

- Students accustomed with the representation of data, addressing modes, and instructions sets.
- Students able to understand parallelism both in terms of a single processor and multiple processors
- Technical knowhow of parallel hardware constructs to include instruction-level parallelism for multi core processor design

Text Books

CS607: Advanced Programming Laboratory   

Credit: 2

Objectives
- To explore the features of object oriented programming.
- To focus programming rather on programming language.
- To understand the OS internals.

Exercises using Linux tools – Grep, awk, tr
Exercises using system calls
Exercises in Python
Exercises in C++/ Java

Outcomes
- Ability to develop shell scripts for various applications.
- Gaining knowledge about OS internals.
- Understanding Object oriented concepts and developing software modules.

Reference Books
CS609: Computer System Design Laboratory

Credit: 2

Objective
- To understand the functionality of the various modules of a computer system.
- To build computer systems from components.

Exercises
1. Comparative study of motherboards from INTEL, AMD and ARM with focus on performance.
2. Study of GPUs using NVIDIA boards.
3. Study of memory sub systems with focus on performance.
4. Study of Reconfigurable hardware using FPGA boards.
5. Study of display cards, RAM, Sound cards, disk and I/o interfaces.
6. Understanding BIOS and CMOS settings.

Outcome
- Ability to build computer systems from components for various specifications.
- Gaining knowledge on the architecture of the computer systems.

References
Second Semester
CS602: Mathematical Foundations for Computer Science
Credit: 3

Objective
- Study the fundamental concepts of logic, abstract algebra, linear algebra, probability and statistics, graph theory etc.

Unit I
Functional Logic: Proposition Logic, Resolution Proof system, Predicate logic. Congruences, Fermat's theorem, Euler function, Chinese remainder theorem.

Unit II
Groups, homomorphism theorems, cosets and normal subgroups, Lagrange’s theorem, Ring. Field. Linear algebra: Vector Space, Basis, Matrices and Linear Transformations, Eigen values, Orthogonality.

Unit III
Counting, Probability, Discrete random variable, Continuous random variable, Moment generating function, Markov’s inequality, Chebyshev’s inequality, The geometric and binomial distributions, The tail of the binomial distribution.

Unit IV
Graphs, Euler tours, planar graphs, Hamiltonian graphs, Euler's formula, applications of Kuratowski's theorem, graph colouring, chromatic polynomials, trees, weighted trees, the max-flow min-cut theorem.

Unit V

Outcome
- Will be able to use mathematical foundations in many areas of computer science like algorithms, computer networks, cryptography, etc.

Text Books
1. Donald F. Stanat and David F. McAllister, Discrete mathematics in Computer Science.
2. Thomas Koshy, Elementary number theory with Applications, Elsevier.
CS604: Service Oriented Architecture and Web Security
Credit: 3

Objective:
- To provide an overview of XML Technology and modeling databases in XML
- To provide an overview of Service Oriented Architecture and Web services and their importance
- To introduce Security solutions in XML and Web Services and to introduce Security standards for Web Services

UNIT I XML Technology

UNIT II SOA Basics
Service Oriented Architecture (SOA) – Comparing SOA with Client-Server and Distributed architectures - Characteristics of SOA – Benefits of SOA -- Principles of Service orientation – Service layers - Business Process management

UNIT III Web Services (WS)

UNIT IV WS Technologies and Standards

UNIT V XML and WS Security

Outcome:
- The students will understand the basics of XML
- The students will learn the concepts of SOA and Web services, some of the prevailing standards and technologies of Web Services
- The students will also learn the approaches for providing security for XML documents as well as messages exchanged among Web Services

Text Books:

Reference Books:
CS606: Advanced Database Management System

Credit: 3

Objective
- To understand the basic concepts and terminology related to DBMS and Relational Database Design
- To the design and implement Distributed Databases.
- To understand advanced DBMS techniques to construct tables and write effective queries, forms, and reports

Unit I
Formal review of relational database and FDs Implication, Closure, its correctness

Unit II
3NF and BCNF, Decomposition and synthesis approaches, Review of SQL99, Basics of query processing, external sorting, file scans

Unit III
Processing of joins, materialized vs. pipelined processing, query transformation rules, DB transactions, ACID properties, interleaved executions, schedules, serialisability

Unit IV
Correctness of interleaved execution, Locking and management of locks, 2PL, deadlocks, multiple level granularity, CC on B+ trees, Optimistic CC

Unit V
T/O based techniques, Multiversion approaches, Comparison of CC methods, dynamic databases, Failure classification, recovery algorithm, XML and relational databases

Outcome
- Exposure for students to write complex queries including full outer joins, self-join, sub queries, and set theoretic queries.
- Knowhow of the file organization, Query Optimization, Transaction management, and database administration techniques

Text Books

Reference Books
1. K. V. Iyer, Lecture notes available as PDF file for classroom use.
CS608: Network Programming Laboratory

Credit: 2

Objective

- Create client and server applications using the "Sockets" API and the implementation of Data link layer protocol and TCP layer
- Ability to conduct computer communication network simulations. Development of computer network simulation and modeling techniques using OPNET simulation software.

Experiments

1. Exercises on Socket Programming using C and Java
2. Exercises using OPNET Network Simulator
   a. Setting up of various network topologies
   b. Implementation of various MAC protocols
   c. Measurement of routing protocols
   d. Analysis of TCP/IP protocol under various mechanisms
   e. Setting up of network that carries various application protocols and analyzing the performances
3. Creation of XML documents and verification using DTDs and Schemas.
4. Transformation of XML documents to XHTML documents for presentation using XSL.
5. Development and deployment of Web Services using Dot Net and J2EE technologies.
6. Composition of Web services using BPEL.

Outcome

- Understanding of the working principle of Socket programming
- Familiarization with the OPNET toolkit

References

CS610: Advanced DBMS Laboratory

Credit: 2

Objective:
- To explore the features of a Database Management Systems
- To interface a database with front end tools
- To understand the internals of a database system

Experiments
- Basic SQL
- Intermediate SQL
- Advanced SQL
- ER Modeling
- Database Design and Normalization
- Accessing Databases from Programs using JDBC
- Building Web Applications using PHP & MySQL
- Indexing and Query Processing
- Query Evaluation Plans
- Concurrency and Transactions
- Big Data Analytics using Hadoop

Outcome:
- Ability to use databases for building web applications.
- Gaining knowledge about the internals of a database system.

References
CS648: Seminar
Credit: 2

Objective
- To develop soft skill
- To understand research papers and prepare presentation material
- To improve oral communication skills through presentation
- To prepare original technical write up on the presentation

Methodology
- To choose the area of interest
- To identify current literatures
- To choose state of the art survey paper/research paper
- To consult and get confirmed with Seminar Coordinator (Faculty)
- To prepare the PPT
- To present as per schedule drawn by Seminar Coordinator
- To prepare a technical write up and submit to Seminar Coordinator

Outcome
- Improvement in proficiency in English
- Improvement in presentation skill
- Improvement in analytical and reasoning ability
- Improvement in technical writing

CS650: Internship *
Credit: 2

Objective
- To develop institute-industry interaction
- To know the industry practices
- To understand cutting edge technology in the chosen area

Methodology
- To identify industries offering internship by Training and Placement Office
- To identify industries offering internship by students in consultation with the Internship Coordinator (Faculty) and Training and Placement Office
- To avail during summer vacation (not more than 3 months)
- To submit a report based on the work done during internship to the Internship Coordinator
  * Non-Industry Internship students will take up the internship with a faculty member

Outcome
- Exposure to industry practices
- Strengthened institute-industry relationship
- Bridging academic knowledge with industry input
Electives for First Semester
CS653: Advanced Network Principles and Protocols

Credit: 3

Objective
- Understand the architecture of the Internet protocols as a layered model
- To understand the fundamentals of data transmission, encoding and multiplexing
- To understand how the various components of wide area networks and local area networks work together

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

Unit-II

Unit-III
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.

Unit-IV

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

Outcome
- Familiarization of the different layers of TCP/IP protocol stack
- Understanding of the working principle of different protocols at different layers

Text Books

Reference Book
CS613: Design and Analysis of Parallel Algorithms

Credit: 3

Objective

- To learn about parallel computing models, design and analyze parallel algorithms for PRAM machines and Interconnection networks.

UNIT I

UNIT II
Selection - broadcast- all sums- parallel selection. Searching a random sequence, sorted sequence on PRAM models, Tree and Mesh.

UNIT III
Merging - A network for merging - merging on PRAM models. Sorting on a linear array, EREW, CREW and CRCW SIMD models, MIMD Enumeration sort.

UNIT IV

UNIT V

Outcome:

- To enable the student to design and analyze parallel algorithms

Text book:

CS655: Digital Forensics

Credit: 3

Objective

- To understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.
- To understand how to examine digital evidences such as the data acquisition, identification analysis.

Unit -I
Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues.

Unit- II
Understanding Computing Investigations – Procedure for corporate High-Tech investigations, understanding data recovery work station and software, conducting and investigations.

Unit-III
Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools.

Unit-IV
Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case.

Unit-V
Current computer forensics tools- software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.

Outcome

- Know how to apply forensic analysis tools to recover important evidence for identifying computer crime.
- To be well-trained as next-generation computer crime investigators.

Text Books:

Reference Books:
CS617: Principles of Cryptography

Credit: 3

Objective

- To gain knowledge about the mathematics of the cryptographic algorithms.
- To get an insight into the working of different existing cryptographic algorithms.
- To learn how to use cryptographic algorithms in security.

Unit-I
Algebra: Group, cyclic group, cyclic subgroup, field, probability. Number Theory: Fermat's theorem, Cauchy's theorem, Chinese remainder theorem, primality testing algorithm, Euclid's algorithm for integers, quadratic residues, Legendre symbol, Jacobi symbol etc.

Unit-II
Cryptography and cryptanalysis, Classical Cryptography, substitution cipher, different type of attack: CMA, CPA, CCA etc, Shannon perfect secrecy, OTP, Pseudo random bit generators, stream ciphers and RC4.

Unit-III
Block ciphers: Modes of operation, DES and its variants, AES, linear and differential cryptanalysis.

Unit-IV
One-way function, trapdoor one-way function, Public key cryptography, RSA cryptosystem, Diffie-Hellman key exchange algorithm, Elgamal Cryptosystem.

Unit-V

Outcome

- Building a new unbreakable cryptosystem
- Blending the existing cryptographic algorithms with the existing communication protocols
- Analyzing and application of cryptography for secure eCommerce and other secret transactions

Textbook:

Reference Books:
CS619: Computer Graphics and Image Processing

Credit: 3

Objective:
- To understand basic algorithms for computer graphics and image processing.
- To understand various filters, Point processing, and Arithmetic operations in image processing.
- To understand different applications of graphics and image processing.

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V

Outcome
Students are able to develop software tools such as
- Games, Animation, and Recognition system

Text Book

Reference Books
CS621: Imaging and Multimedia Systems

Credit: 3

Objective
- To understand the basics of image processing and image security techniques
- To study various compression and file formats used in imaging and multimedia systems
- To analyze different media and design issues related to multimedia systems

Unit I Introduction

Unit II Compression and File Formats

Unit III Image Computing and Security

Unit IV I/O Technologies

Unit V Application Design

Outcome
- Technical know to develop new compression standards
- Acquire skill set to handle all multimedia components efficiently
- Develop Integrated and Collaborative multimedia systems
Text Books

References
CS623: Open Source Programming

Credit: 3

Objective

- To understand Open Source Programming concepts
- To build applications based on Open Source Softwares

UNIT I - INTRODUCTION
Introduction to open source programming languages, advantages and drawbacks of open source programming, threats and vulnerabilities in open source languages, Operating System – Ubuntu Linux – Introduction to shell programming.

UNIT II – PHP
PHP Language Basics, Functions - calling a function, variable function, and anonymous function, Strings - cleaning, encoding and escaping, and comparing strings, Arrays – storing data in arrays, extracting multiple values, traversing, and sorting arrays, Objects – creation, introspection, and serialization, Web Techniques – processing forms and maintaining state.

UNIT III – WEB DATABASE APPLICATIONS
Three-tier architecture, Introduction to Object oriented programming with PHP 5, Database basics, MYSQL - querying web databases, writing to web databases, validation with Javascript, Form based authentication, protecting data on the web.

UNIT IV – PERL, TCL, AND PYTHON
Numbers and Strings, Control Statements, Lists and Arrays, Files, Pattern matching, Hashes, Functions. Introduction to TCL/TK, Introduction to Python.

UNIT V – SECURITY IN WEB APPLICATIONS

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

- develop codes in open source web applications
- understand the risks associated with the open source codes
- write secure CGI scripts

Text Book
References

3. Online Tutorials and Recent IEEE/ACM Journal Papers
Electives for Second Semester
CS612: Distributed Systems

Credit: 3

Objective
- To have a broad and up-to-date coverage of the principles and practice in the area of Distributed Systems.
- To understand the heterogeneous systems such as computers, mobile phones, other devices and Internet) and their functionalities.

UNIT I Basic Concepts
Definition of a distributed systems, Examples, Resource sharing and the Web, Challenges, System models, Architectural and fundamental models, Networking Interprocess communication, External data representation and marshalling, Client-server and Group communication.

UNIT II Distributed Objects and Process
Distributed objects and remote invocation, Communication between distributed objects, Remote procedure call, Events and notifications - The operating system layer, Protection, Processes and Threads, Communication and invocation, OS Architecture. Security techniques, Cryptographic algorithms, Access control, Digital signatures, Cryptography pragmatics, Needham-Schroeder, Kerberos, Securing electronics transaction, IEEE 802.11 WiFi.

UNIT III Operating System Issues
Distributed file systems - Name services, Domain name system, Directory and discovery services, Peer to peer systems, Napster file sharing system, Peer to peer middleware routing overlays – Clocks, Events and process states Clock Synchronization - Logical clocks Global states - Distributed debugging - Distributed mutual exclusion - Elections - Multicast communication.

UNIT IV Distributed Transaction Processing
Transactions - Nested transactions - Locks - Optimistic concurrency control - Timestamp ordering - Flat and nested distributed transactions - Atomic commit protocols - Concurrency control in distributed transactions - Distributed deadlocks - Transaction recovery - Overview of replication, Distributed shared memory and Web services.

UNIT V Distributed Algorithms
Outcome

- Developing skill set in developing a distributed system.
- Designing and evaluation of algorithms and protocols for various distributed systems.

Textbook

CS614: Wireless Sensor Networks  
Credit: 3

Objective
- To understand the fundamentals of wireless sensor networks and its application to critical real time scenarios.
- To study the various protocols at various layers and its differences with traditional protocols.
- To understand the issues pertaining to sensor networks and the challenges involved in managing a sensor network.

Unit I
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.

Unit II
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.

Unit III

Unit IV

Unit V
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.

Outcome
- Technical knowhow in building a WSN network.
- Analysis of various critical parameters in deploying a WSN

Text Book

Reference Book
CS616: Advanced Digital Design

Credit: 3

Objective
- To understand the basic building blocks, logic gates, adders, multipliers, shifters and other digital devices
- To apply logic minimization techniques, including Karnaugh Maps
- To learn techniques and tools for programmable logic design

Unit – I
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

Unit – II

Unit – III

Unit – IV
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 – Design Example of Pipelined Adder, Pipelined FIR Filter – Circular buffers – FIFOs and Synchronization across clock domains – Functional units for addition, subtraction, multiplication and division – Multiplication of signed binary numbers and fractions.

Unit – V
Outcome

- Students understand the use standard digital memory devices as components in complex subsystems
- Technical knowhow to design simple combinational logic circuits and logic controllers
- Acquire skill set to develop the necessary software for basic digital systems

Text Book


Reference Books

CS618: Real Time Systems

Credit: 3

Objectives
- To study issues related to the design and analysis of systems with real-time constraints.
- To learn the features of Real time OS.
- To study the various Uniprocessor and Multiprocessor scheduling mechanisms.
- To learn about various real time communication protocols.
- To study the difference between traditional and real time databases

UNIT I
Introduction to real time computing - Concepts; Example of real-time applications – Structure of a real time system – Characterization of real time systems and tasks - Hard and Soft timing constraints - Design Challenges - Performance metrics - Prediction of Execution Time : Source code analysis, Micro-architecture level analysis, Cache and pipeline issues- Programming Languages for Real-Time Systems

UNIT II
Real time OS – Threads and Tasks – Structure of Microkernel – Time services – Scheduling Mechanisms Communication and Synchronization – Event Notification and Software interrupt

UNIT III
Task assignment and Scheduling - Task allocation algorithms - Single-processor and Multiprocessor task scheduling - Clock-driven and priority-based scheduling algorithms- Fault tolerant scheduling

UNIT IV
Real Time Communication -Network topologies and architecture issues – protocols – contention based, token based, polled bus, deadline based protocol, Fault tolerant routing. RTP and RTCP.

UNIT V
Real time Databases – Transaction priorities – Concurrency control issues – Disk scheduling algorithms – Two phase approach to improve predictability.

Outcomes
- Knowledge about Schedulability analysis.
- Ability to learn Real-time programming environments.
- Knowledge about real time communication and databases.
- Ability to develop real time systems.

Text Book

Reference Books
CS620: Mobile Network Systems

Credit: 3

Objective

- To understand the fundamentals of Mobile communication systems.
- To understand the different multiplexing scheme.
- To understand the significance of different layers in mobile system.

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

UNIT II – MAC
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.

UNIT III – COMMUNICATION SYSTEMS
Mobile Telecommunication standards, GSM, DECT, TETRA, IMT-2000, CTEO, satellite systems – GEO, LEO and MEO, and broadcast systems –Digital audio and video broadcasting, IEEE 802.11, HIPERLAN, Bluetooth, Wireless ATM, WATM services.

UNIT IV – MOBILE NETWORK LAYER
Network support for mobile systems – Mobile IP- IP packet delivery- Agent discovery-tunneling and encapsulation, reverse tunneling, IPV6, DHCP.

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

Outcome

- Understand the concepts of mobile and wireless communications.
- Apply the knowledge gained in exploring, application and protocol development.

Text Book

Reference Book
CS652: Network Security

Credit: 3

Objective

- To understand the network security, services, attacks, mechanisms, types of attacks on TCP/IP protocol suite.
- To comprehend and apply authentication services, authentication algorithms
- To comprehend and apply network layer security protocols, Transport layer security protocols, Web security protocols.
- To understand the wireless network security threats.

Unit -I

Unit-II

Unit-III

Unit-IV
Intruders, Viruses, Worms, Trojan horses, Distributed Denial-Of-Service (DDoS), Firewalls, IDS, Honey nets, Honey pots.

Unit-V

Outcome

- Be able to determine appropriate mechanisms for protecting the network.
- Design a security solution for a given application, system with respect to security of the system

Text Books:

Reference Books:
CS624: Data Warehousing and Data Mining

**Objective**
- To understand the principles of Data warehousing and Data Mining.
- To be familiar with the Data warehouse architecture and its Implementation.
- To know the Architecture of a Data Mining system.
- To understand the various Data preprocessing Methods.
- To perform classification and prediction of data.

**UNIT I**

**UNIT II**

**UNIT III**

**UNIT IV**

**UNIT V**

**Outcome**
- Technical knowhow of the Data Mining principles and techniques for real time applications.

**Text Book**
Reference Books
CS626: Cloud Computing

Credit: 3

Objectives
- To define Cloud Computing
- To provide an in-depth and comprehensive knowledge of the Cloud Computing fundamental issues, technologies, applications and implementations.
- To expose the students to the frontier areas of Cloud Computing
- To motivate students to do programming and experiment with the various cloud computing environments
- To shed light on the Security issues in Cloud Computing
- To introduce about the Cloud Standards

UNIT I

UNIT II

UNIT III
Service models - Infrastructure as a Service (IaaS) - Resource Virtualization: Server, Storage, Network - Case studies. Platform as a Service (PaaS) - Cloud platform & Management: Computation, Storage - Case studies. Software as a Service (SaaS) - Web services - Web 2.0 - Web OS - Case studies – Anything as a service (XaaS).

UNIT IV

UNIT V

Outcomes
- Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
- Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
- Explain the core issues of cloud computing such as security, privacy, and interoperability.
• Provide the appropriate cloud computing solutions and recommendations according to the applications used.
• Collaboratively research and write a research paper, and present the research online.

Text Book
1. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, “Distributed and cloud computing from Parallel Processing to the Internet of Things”, Morgan Kaufmann, Elsevier – 2012

Reference Books
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly 2009